INEEL/EXT-02-00542
Revision 1
Project No. 021052

Field Sampling Plan for the OU 7-10 Glovebox Excavator Method Project

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March 2003

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Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Prepared under Contract No. 00007724
for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-99ID13727

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Approved

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ABSTRACT

The OU 7-10 Glovebox Excavator Method Project was approved by the U.S. Department of Energy to (1) demonstrate retrieval of 75 to 125 yd^3 of buried transuranic waste and contaminated soil from Operable Unit 7-10 at the Subsurface Disposal Area within the Radioactive Waste Management Complex of the Idaho National Engineering and Environmental Laboratory, (2) to provide information on contaminants present in the underburden, and (3) to characterize and package waste zone material for safe and compliant storage pending a decision on final disposition. This field sampling plan describes how and where samples will be collected to characterize waste zone material and underburden soils to support the project.

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ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	*Code of Federal Regulations*
COC	chain of custody
D&D&D	deactivation, decontamination, and decommissioning
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objective
EDTA	ethylenediaminetetraacetic acid
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
ESD	explanation of significant differences
FFA/CO	Federal Facility Agreement and Consent Order
FSP	field sampling plan
IAG	interface agreement
ID	identification
INEEL	Idaho National Engineering and Environmental Laboratory
MCP	management control procedure
MTRU	mixed transuranic waste
NPL	National Priorities List
OU	operable unit
PCB	polychlorinated biphenyl
PGS	Packaging Glovebox System
PPE	personal protective equipment
QA	quality assurance
QA/QC	quality assurance and quality control
QAPjP	quality assurance project plan

QC	quality control
RCRA	Resource Conservation and Recovery Act
RCS	Retrieval Confinement Structure
RFP	Rocky Flats Plant
ROD	record of decision
RWMC	Radioactive Waste Management Complex
SAP	sampling and analysis plan
SDA	Subsurface Disposal Area
SVOC	semivolatile organic compound
TBD	to be determined
TPR	technical procedure
TRU	transuranic
TSCA	Toxic Substances Control Act
UCL_{90}	upper 90% confidence level
VOC	volatile organic compound
WAC	waste acceptance criteria
WAG	waste area group
WAP	waste analysis plan
WIPP	Waste Isolation Pilot Plant

Field Sampling Plan for the OU 7-10 Glovebox Excavator Method Project

1. INTRODUCTION AND SITE BACKGROUND

This field sampling plan (FSP) describes the collection and analysis of samples used for characterization activities in support of the Operable Unit (OU) 7-10 Glovebox Excavator Method Project within the Subsurface Disposal Area (SDA) of the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering and Environmental Laboratory (INEEL).

Between 1967 and 1969, the OU 7-10 site (which comprises Pit 9) was used for disposal of radioactively contaminated waste at the SDA. The RWMC is a facility located in the southeast portion of the INEEL. Waste Area Group (WAG) 7 is the designation for the RWMC recognized under the Federal Facilities Agreement and Consent Order (FFA/CO) (DOE-ID 1991) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 USC § 9601 et seq.).

1.1 Objectives of the Project

The *Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory, Idaho Falls, Idaho* (DOE-ID 1993) specifies retrieval of transuranic (TRU) waste from OU 7-10 (Pit 9). On October 1, 2001, the INEEL published the *Waste Area Group 7 Analysis of OU 7-10 Stage II Modifications* (INEEL 2001), which identified a feasible approach for retrieving waste from OU 7-10. The project was established to accomplish the objectives presented in that report. The overall objectives for the project are as follows:

1. Demonstrate waste zone material retrieval
2. Provide information on contaminants present in the underburden
3. Characterize waste zone material for safe and compliant storage
4. Package and store waste onsite, pending final disposition.

The project facilities and processes are being designed to safely conduct a waste zone material retrieval demonstration in a selected area of OU 7-10. The volume retrieved is expected to be between 75 and 125 yd^3. The project processes consist of excavation and retrieval; sampling, packaging, and provisional storage; shutdown; deactivation, decontamination, and decommissioning (D&D&D); and environmental monitoring. Project facilities include a Weather Enclosure Structure, Retrieval Confinement Structure (RCS), excavator, ventilation system, and other supporting equipment. The packaged waste zone material retrieved by the project will be transferred to an onsite facility for temporary storage pending final disposition.

1.2 Scope of the Field Sampling Plan

The work described in this FSP will be used to:

1. Characterize retrieved waste zone materials for safe and compliant storage in accordance with agreed project objectives
2. Characterize underburden soil contaminants to support subsurface migration evaluations.

This FSP and the *Quality Assurance Project Plan for WAGs 1, 2, 3, 4, 5, 6, 7, and 10 and Inactive Sites* (QAPjP) (DOE-ID 2002a) together are considered the sampling and analysis plan for the project. This FSP has been prepared in accordance with INEEL Management Control Procedure (MCP) -241, "Preparation of Characterization Plans." This FSP describes the field activities that are part of the investigation, and the QAPjP describes the processes and programs that ensure the generated data will be suitable for the intended use.

Third-party groups (i.e., regulatory agencies) may request collection of samples, some of which may not be specifically described in this plan. If acceptable to the project, the samples would be processed using protocol consistent with this plan. Sample transportation would be the responsibility of the third party. In addition, once the samples are turned over, ownership, handling, and disposition of these materials are the responsibility of the receiving party in accordance with binding legal agreements that will be established outside of this plan. In instances when third-party samples are collected, additional collocated samples will be taken for WAG 7 and may be archived pending analyses.

1.3 Site Background

The INEEL is a U.S. Department of Energy (DOE) facility, located 52 km (32 mi) west of Idaho Falls, Idaho, which occupies 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Idaho Snake River Plain. The RWMC is located in the southwestern portion of the INEEL, as shown in Figure 1. The SDA is a 39-ha (97-acre) area located in the RWMC. Waste Area Group 7 is the designation recognized by CERCLA (42 USC § 9601 et seq.) and in the FFA/CO (DOE-ID 1991) for the RWMC, which comprises the SDA buried waste site. Waste Area Group 7 has been subdivided into 13[a] OUs. Operable Unit 7-10, which comprises Pit 9, is located in the northeast corner of the SDA. The OU 7-10 site is an area into which chemicals, radioactive materials, and sludge from DOE weapons plants and other government programs were disposed. While such disposal at the RWMC began in 1952, OU 7-10 was used and filled in the late 1960s. This project involves a designated portion of OU 7-10, as illustrated in Figure 2.

The project location is in the southwest end of the OU 7-10 area. It is defined by a fan-shaped area with a 6-m (20-ft) radius and the angular extent of 145 degrees. Figure 3 presents the plot plan of the OU 7-10 area showing infrastructure and the project location. Operable Unit 7-10 itself measures approximately 115.5 × 38.7 m (379 × 127 ft).

1.3.1 Site History

The RWMC was established in the early 1950s as a disposal site for the permanent landfill disposal of radioactive waste. Radioactive waste has been buried at the SDA in underground pits, trenches, unlined soil vaults, and one aboveground pad (Pad A). Disposal of TRU waste occurred in the SDA from 1952 to 1970, the primary source of which was from the production of plutonium components for nuclear weapons at Rocky Flats Plant (RFP).[b] Waste from RFP was placed in OU 7-10 from November 1967 to June 1969. Since 1970, TRU waste has been placed on asphalt pads in interim storage at the Transuranic Storage Area. Acceptance of TRU waste from off-Site generators was discontinued in 1988.

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a. Operable Units 13 and 14 were combined into the comprehensive remedial investigation and feasibility study in 1995 (Huntley and Burns 1995).

b. The Rocky Flats Plant is located 26 km (16 mi) northwest of Denver. In the mid-1990s, it was renamed the Rocky Flats Environmental Technology Site. In the late 1990s, it was again renamed, to its present name, the Rocky Flats Plant Closure Project.

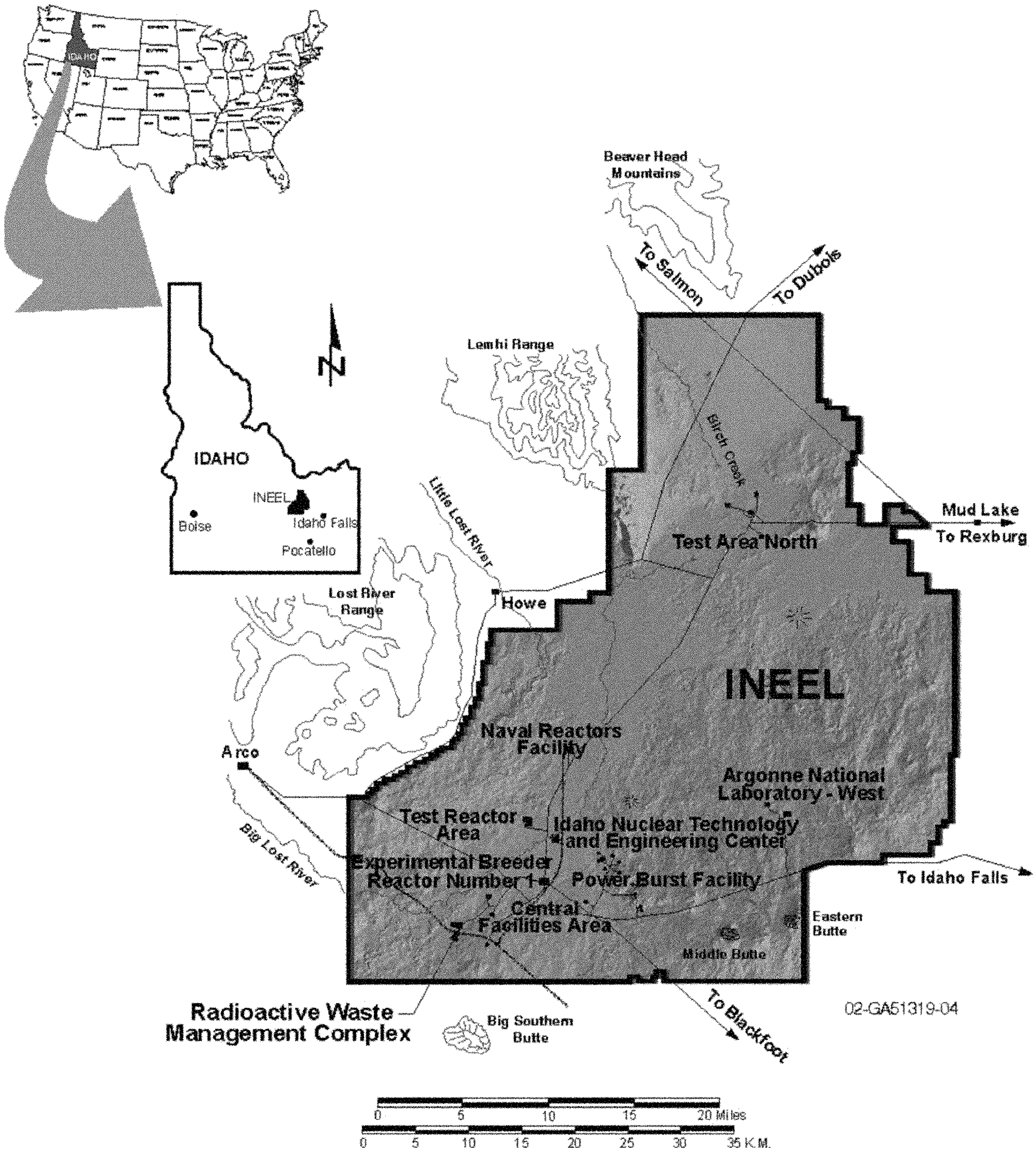

Figure 1. Location of the Radioactive Waste Management Complex within the Idaho National Engineering and Environmental Laboratory.

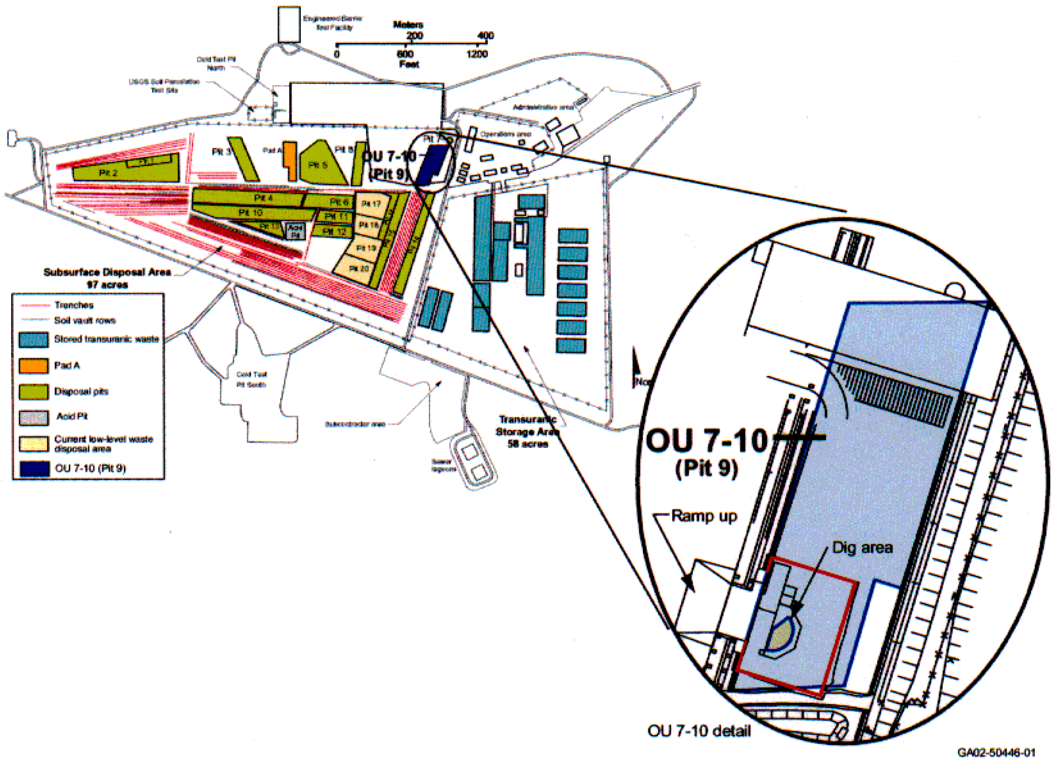

Figure 2. Diagram of the Radioactive Waste Management Complex with an expanded view of the OU 7-10 Glovebox Excavator Method Project area.

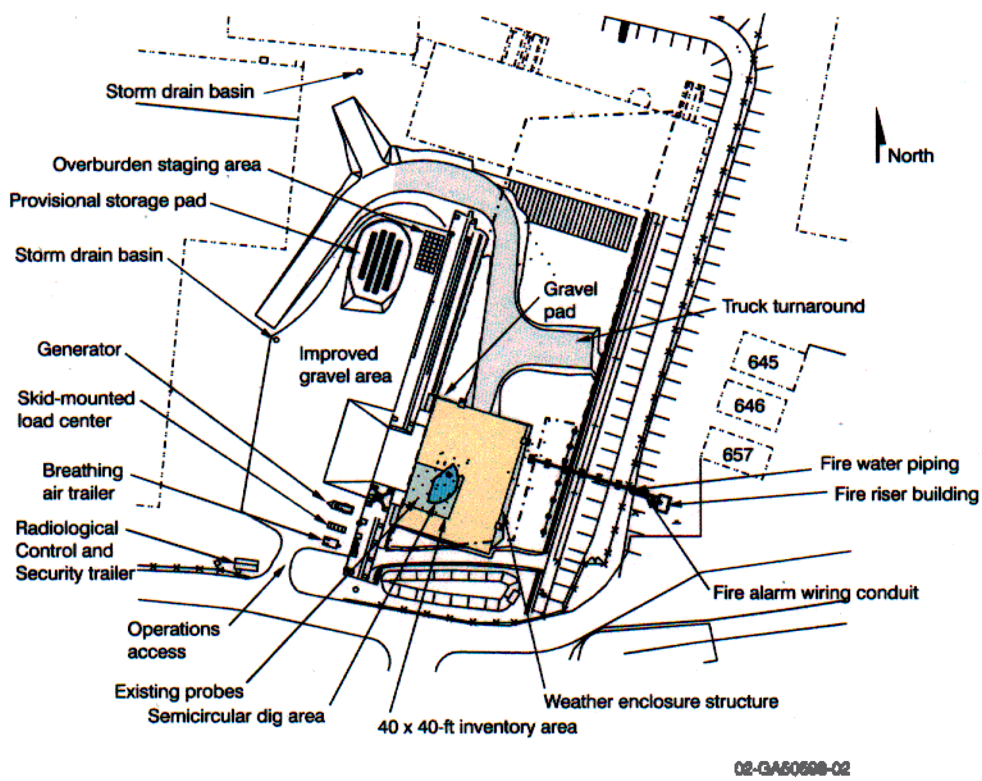

Figure 3. Diagram of the OU 7-10 area and the project site (fan-shaped area).

Detailed history of the disposal operations at the RWMC may be found in *A History of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory* (EG&G 1985). No waste disposal has occurred at OU 7-10 since its closure in 1969.

In August 1987, DOE and the U.S. Environmental Protection Agency (EPA) entered into a Consent Order and Compliance Agreement (DOE-ID 1987) in accordance with the Resource Conservation and Recovery Act (RCRA) Section 3008(h) (42 USC § 6901 et seq.). The Consent Order and Compliance Agreement required DOE to conduct an initial assessment and screening of all solid waste and hazardous waste disposal units at the INEEL and set up a process for conducting any necessary corrective actions. On July 14, 1989, the INEEL was proposed for listing on the National Priorities List (NPL) (54 FR 29820). The listing was proposed by the EPA under the authorities granted EPA by CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (Public Law 99-499). The final rule that listed the INEEL on the NPL was published on November 21, 1989, in 54 FR 48184, "National Priorities List of Uncontrolled Hazardous Waste Sites; Final Rule." As a result of the listing of INEEL on the NPL, the DOE, EPA, and the Idaho Department of Environmental Quality entered into the FFA/CO on December 9, 1991. Operable Unit 7-10 was identified for an interim action under the FFA/CO as described in the *Record of Decision: Declaration for Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory, Idaho Falls, Idaho* (DOE-ID 1993).

Several changes to the original OU 7-10 Record of Decision (ROD) (DOE-ID 1993) were documented through Explanations of Significance Difference (ESDs) to the OU 7-10 ROD documents issued in 1995 and 1998 (DOE-ID 1995, 1998). The first ESD adjusted the estimated cost of the project (DOE-ID 1995). The second ESD gave the framework for the current staged approach to remediation of OU 7-10 (DOE-ID 1998). The current approach, the OU 7-10 Glovebox Excavator Method Project, is detailed in the *Waste Area Group 7 Analysis of OU 7-10 Stage II Modifications* (INEEL 2001).

1.3.2 Existing Information and Contaminants of Interest

Inventories of waste in OU 7-10 and the SDA pits and trenches have been generated using existing and available historical records. The inventories contain uncertainties about various items including exact locations of waste inside the pit, extent of contaminant migration, specific isotopic information and chemical form, and valence state of the contaminants.

Approximately 3,115 m^3 (110,000 ft^3) of the estimated 4,250 m^3 (150,000 ft^3) of the waste in OU 7-10 was generated at the RFP. Other materials in OU 7-10 include low-level waste (LLW) from generators located at the INEEL. The waste in OU 7-10 was produced from RFP weapons production operations and INEEL nuclear reactor testing activities and includes a variety of radionuclides, organic, and inorganic compounds. The OU 7-10 ROD contains an inventory of these materials (DOE-ID 1993). In addition to waste, the pit contains an estimated 7,100 m^3 (250,000 ft^3) of overburden soil and approximately 9,900 m^3 (350,000 ft^3) of interstitial and underburden soil.

The depth of the pit from ground surface to the bedrock is approximately 6 m (20 ft). The soil cover or overburden has been estimated to be 1.2 to 1.8 m (4 to 6 ft) thick.

The OU 7-10 ROD inventory was compiled from two documents: (1) *Nonradionuclide Inventory in Pit 9 at the RWMC* (Liekhus 1992), which was converted from an earlier report, *Nonradionuclide Inventory in Pit 9 at the RWMC* (Liekhus 1991), and (2) *Methodology for Determination of a Radiological Inventory for Pit 9 and Corresponding Results* (King 1991). Since the OU 7-10 ROD was written, a number of refinements to the inventory estimates have been made based on various new information sources. The current OU 7-10 inventory document is *Pit 9 Estimated Inventory of*

Radiological and Nonradiological Constituents (Einerson and Thomas 1999), which estimates the inventory for the entire disposal pit from all generators. However, this inventory does not focus on the Stage I and II area in the southern portion of OU 7-10 where this project is being conducted. Stage I and II refers to a portion of the framework for a staged approach to remediation of OU 7-10, as described in *Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1998).

Inventory information pertinent to the Stage I and II areas is summarized in Table 1. As previously stated, this inventory is the best available information based on incomplete historical records. The OU 7-10 Stage I and II area contains waste streams from the RFP. It has been determined that waste from various INEEL facilities was disposed of elsewhere in OU 7-10. The waste in the Stage I and II area of OU 7-10 was shipped from the RFP in 55-gal drums (Clements 1982). The drum quantity estimates shown on Table 1 are for the entire 12 × 12-m (40 × 40-ft) Stage I and II area[c] and for the project retrieval area (INEEL 2002a). The project retrieval area includes only a portion of the overall 12 × 12-m (40 × 40-ft) Stage I and II retrieval area. Figure 3 depicts the proposed excavation and retrieval area.

As the summary on Table 1 shows, the RFP waste forms contain various radiological and nonradiological contaminants. The material shipped to OU 7-10 from RFP included weapons-grade plutonium and uranium isotopes. Weapons-grade plutonium (i.e., Pu-52) contains Pu-238, Pu-239, Pu-240, Pu-241, and Pu-242. Uranium isotopes shipped to the RWMC included U-235 and U-238. Also included in the waste shipments were Am-241 and Np-237, which are daughter products resulting from the radioactive decay of Pu-241. In addition to the Am-241 produced by the decay of the inventory, Am-241 removed from Pu-52 during processing at the RFP also was disposed of in OU 7-10. This extra Am-241 is a significant contributor to the total radioactivity located in OU 7-10. A number of radionuclides primarily from INEEL waste generators (e.g., Co-60, Cs-137, Sr-90, Y-90, and Ba-137) are not expected to be encountered in the project area.

The primary organic chemicals known to be in OU 7-10 include carbon tetrachloride, trichloroethene, 1,1,1-trichloroethane, tetrachloroethene, lubricating oils, Freon 113, alcohols, organic acids, and versenes (ethylenediaminetetraacetic acid [EDTA]). Examples of inorganic chemicals known to be in the waste include hydrated iron, zirconium, beryllium, lead, sodium nitrate, potassium nitrate, cadmium, dichromates, potassium phosphate, potassium sulfate, silver, asbestos, and calcium silicate. A few nonradiological constituents have been reported as having been disposed of somewhere in the SDA and may be in OU 7-10. However, it is not known if these constituents were disposed of in OU 7-10 and verification is not possible. They include sodium and potassium cyanide, lithium oxide, mercury, nitrobenzene, picric acid, and polychlorinated biphenyls (PCBs). Waste management activities will be based on information from the various inventory documents identified in the preceding paragraphs. In addition, analytical data collected during project activities will be used to determine appropriate waste management.

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c. R. W. Thomas Interdepartmental Memorandum to D. E. Wilkins, April 16, 1999, "Waste Contents Associated with OU 7-10 Stages I and II Activities in Pit 9," RWT-01-99, Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, LLC, Idaho Falls, Idaho.

Table 1. Waste content in the OU 7-10 Stage I, II, and project retrieval areas.

Waste Stream	Summary Characteristics	Packaging	Estimated Quantity, Stage I and II, 40 × 40 ft	Estimated Quantity, OU 7-10 Glovebox Excavator Method Project Retrieval Area
Series 741 sludge first stage sludge	Salt precipitate containing plutonium and americium oxides, depleted uranium, metal oxides, and organic constituents.	18.1 to 22.7 kg (40 to 50 lb) of Portland cement added to bottom of drum and each of two (inner and outer plastic bags, and the top of the outer bags to absorb any free liquids. Lead sheeting may line inside of the drum as well	3 drums	1 drum
Series 742 sludge second stage sludge	Salt precipitate containing plutonium and americium oxides, metal oxides, and organic constituents.	18.1 to 22.7 kg (40 to 50 lb) of Portland cement added in layers to absorb any free liquids. Waste is double-bagged and drummed.	27 drums	1 drum
Series 743 sludge organic setups	Organic liquid waste solidified using calcium silicate (paste or grease-like).	113.6 L (30 gal) of organic waste mixed with 45.4 kg (100 lb) calcium silicate. Small quantities (4.5 to 9.1 kg [10 to 20 lb]) of Oil-Dri added to top and bottom of drum, if necessary. Double-bagged.	379 drums	50 to 80 drums
Series 744 sludge special setups	Complexing chemicals (liquids) including versenes, organic acids and alcohols solidified with cement.	86.2 kg (190 lb) of Portland cement and 22.7 kg (50 lb) of magnesia cement in drum followed by the addition of 99.9 L (26.4 gal) of liquid waste. Additional cement top and bottom. Double-bagged.	2 drums	1 drum
Series 745 sludge evaporator salts	Salt residue from evaporated liquids from solar ponds containing 60% sodium nitrate, 30% potassium nitrate, and 10% miscellaneous.	Salt residue packaged in plastic bag and drum. Cement added to damp or wet salt, when necessary.	42 drums	8 drums
Noncombustible waste	Various miscellaneous waste such as gloveboxes, lathes, ducting, piping, angle iron, electronic instrumentation, pumps, motors, power tools, hand tools, chairs, and desks.	Varies by process line generating the waste. Waste may have been wrapped in plastic and placed directly into the waste container.	28 drums	5 drums
Combustible waste	Dry combustible materials such as paper, rags, plastics, surgeons' gloves, cloth coveralls and booties, cardboard, wood, wood filter frames, and polyethylene bottles.	Varies by process line generating the waste. Plastic bags used in some instances, but in other instances waste placed directly into waste container.	260 drums	40–60 drums
Graphite	Graphite mold pieces after excess plutonium removal. Molds are broken into large pieces before packaging.	Drums lined with polyethylene bags and, most likely, a cardboard liner.	22 drums	5 drums
Empty 55-gal drums	Empty drums that originally held lathe coolant at the Rocky Flats Plant. Some drums may contain residues.	Single drum placed in cardboard carton.	544 drums	80–120 drums

The TRU radionuclides in OU 7-10 are believed to be primarily contained in the drummed sludge and other RFP waste (e.g., graphite). The buried waste contains TRU radionuclides and low-level waste. For purposes of clarification, the following definitions are provided below:

- **Transuranic radionuclides**—Alpha-emitting radionuclides with an atomic number higher than 92 (DOE Order 435.1).

- **Transuranic waste**—Without regard to source or form, waste that is contaminated with alpha-emitting, TRU radionuclides (atomic number greater than 92) with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. Heads of Operations Offices (e.g., DOE-ID) may determine if other alpha-contaminated waste, peculiar to a specific site, must be managed as TRU waste (DOE Order 435.1). At the INEEL, waste containing Ra-226 and U-233 is included as TRU waste in the *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria* (Revision 14) (DOE-ID 2002b).

- **Low-level waste**—Waste that is not high-level radioactive waste, spent nuclear fuel, TRU waste, by-product material (as defined in Section 11e[2] of the Atomic Energy Act of 1954, as amended), or naturally occurring radioactive material (DOE Order 435.1).

1.4 Report Organization

After the site history given in this section, Section 2 presents the sampling objectives and data quality objectives (DQOs). Section 3 describes the sample locations and frequency. Section 4 provides information about sample designation and associated requirements. Section 5 contains a description of sampling equipment and procedures. Section 6 describes sample handling and analysis including sample labeling and custody requirements. Section 7 discusses management of waste generated from the sampling activities. Section 8 contains the cited references.

2. SAMPLING AND DATA QUALITY OBJECTIVES

The purpose of the sampling is to characterize a portion of the retrieved waste zone material to satisfy the INEEL Waste Acceptance Criteria (WAC) (Revision 16) (DOE-ID 2002c) to ensure safe and compliant storage. The underburden soil will be characterized to collect data on the contaminants of interest to support subsurface contamination migration studies. This section provides the DQOs being fulfilled by the sampling activities performed by the project.

Note: For the purposes of this plan, the sampled portion of this material is called soils and waste solids.

Data needed to support the objectives of this project were determined using the process described in *OU 7-10 Glovebox Excavator Method Project Data Quality Objectives* (INEEL 2002b), wherein the project used a tailored approach to develop applicable DQOs. The resulting DQOs applicable to field sampling are shown in Table 2. To augment the DQOs developed through the project's tailored approach, this section of the FSP used a graded DQO approach more closely aligned with the process established in EPA QA/G-4, "Guidance for the Data Quality Objectives Process" (EPA 1994a), and applied this to the waste zone material. The data gaps, study boundaries, and decision inputs and rules are discussed in this section. The project-controlled sampling activities are only a portion of the overall DQOs required for final disposition of retrieved waste. Some elements required to support final disposition (e.g., nondestructive assay) will be performed outside the requirements of this plan. Therefore, this evaluation only partially fulfills the overall DQOs. The primary objectives of this FSP are to collect information from the waste zone material (i.e., soils and waste solids) in the designated excavation area of OU 7-10 to achieve the following:

- Characterize materials to meet the INEEL WAC, Revision 16 (DOE-ID 2002c)
- Supplement existing acceptable knowledge (i.e., process knowledge) documentation with analytical data to make proper hazardous waste determinations
- Determine if the material is regulated under the Toxic Substances Control Act (TSCA) (15 USC § 2601 et seq.)
- Identify potentially ignitable material
- Verify proper waste packaging.

This information then will be used to support characterization in accordance with the INEEL WAC (Revision 16) (DOE-ID 2002c) and support safe and compliant storage of the packaged waste until final disposition. The DQO approach provided in the following sections is divided into two subsections that focus on the soils and waste solids and other subpopulations. The data gaps, study boundaries, and decisions for the soils and waste solids relative to this project are discussed in Section 2.1.

Other subpopulations may be encountered during excavation that pose a safety or regulatory risk to the project. Included in this category are drums suspected of containing nitrate-bearing waste (because of their ignitable potential that affects both safety and regulatory issues), uncontainerized liquids potentially containing liquid PCBs, cyanide pellets, or other special-case waste, outlier waste, and other unplanned sampling opportunities. Newly packaged drums within these subpopulations will be included in the basic strategy described in Section 2.1; however, individual samples for each at risk drum also will be collected. The data gaps, study boundaries, and decisions for these subpopulations relative to this project are discussed in Section 2.2.

The objectives of the underburden sampling are to evaluate concentrations and characteristics of specific contaminants associated with Rocky Flats waste streams. The contaminants of interest were listed in the OU 7-10 ROD (DOE-ID 1993) and identified for analysis in the future OU 7-13/14 Comprehensive Remedial Investigation/Feasibility Study. This effort is identified as a project requirement and is not evaluated using the graded DQO approach.

2.1 Soils and Waste Solids

2.1.1 Problem

The soils and waste solids described in this plan are associated with significant acceptable knowledge documentation developed through OU 7-10 and OU 7-13/14 CERCLA activities and derived from the Transuranic Waste Program. Analytical data are needed to supplement existing acceptable knowledge information and confirm appropriate RCRA hazardous waste numbers (i.e., waste codes) that apply to the waste streams and the appropriate classification of the waste under TSCA. Documentation of a hazardous waste determination is required to ensure compliance with INEEL WAC related to onsite storage.

2.1.2 Decisions

In general, the project will use acceptable knowledge (where available) to apply RCRA hazardous waste codes to the soils and waste solids across the entire population (see Section 3.2.1). In cases where acceptable process knowledge is lacking, the project will use characterization data collected from the soils and waste solids (e.g., evaluation of the waste characteristics) to evaluate application of additional RCRA hazardous waste codes. Specifically, the following determinations will be made based on characterization data collected from the soils and waste solid samples:

- Levels of specific contaminants present in the soils and waste solids that would cause the waste to be designated as characteristic under RCRA
- Levels of PCBs present in the soils and waste solids at concentrations greater than or equal to 50 ppm that would cause the waste to be regulated under TSCA.

To address these decisions, the project will collect and analyze samples for the target contaminants as identified in the Table 2.

2.1.3 Decision Inputs

The following inputs are needed for the determinations listed in Section 2.1.2:

- Incorporation of acceptable knowledge documentation
- Characterization data from the newly packaged drum population
- Resource Conservation and Recovery Act characteristic hazardous waste thresholds
- Toxic Substances Control Act regulatory thresholds for PCBs
- Idaho National Engineering and Environmental Laboratory WAC.

Table 2. Data quality objectives for the OU 7-10 Glovebox Excavator Method Project.

Objective	Data Use	Measurement	Sampling Method	Analytical Method	Analytical Level	Required Detection Level	Comments and Rationale
Provide characterization data of certain contaminants of interest in the underburden to support subsurface migration evaluations.	Characterize underburden soil contaminants of interest to support subsurface migration evaluations.	1. Am-241 2. Np-237 3. Plutonium isotopes 4. Uranium isotopes 5. Gamma-emitting isotopes 6. Ra-226 7. VOCs 8. Soluble cations: calcium (Ca) magnesium (Mg) strontium (Sr) sodium (Na) potassium (K) iron (Fe) manganese (Mn) chromium (Cr) 9. Soluble anions: chloride (Cl) fluoride (F) bromide (Br) sulfate (SO_4) nitrate (NO_3) as nitrogen (N) nitrite (NO_2) as N orthophosphate (PO_4) as phosphorus (P) 10. Water content.	The project FSP[a] will define sampling details. Conceptual approach involves collection of core samples by using the remotely operated excavator. Underburden cores will be collected by inserting a sampling tube to refusal or a maximum depth of 4.5 ft, whichever occurs first. To prevent the core from falling apart in the core barrel, a compressible plug will be placed in the core barrel before sampling. The plug will fit tight enough so that it does not move freely but can be readily displaced as the core moves up into the core barrel.	1. Alpha spectroscopy 2. Alpha spectroscopy 3. Alpha spectroscopy 4. Alpha spectroscopy 5. Gamma spectroscopy 6. Alpha spectroscopy 7. SW-846-8260B 8. Distilled water extraction followed by centrifuge separation. Extract will be analyzed using inductively coupled plasma. 9. Distilled water extraction followed by centrifuge separation. Extract will be analyzed using ion chromatography. 10. Gravimetric methods (weigh, dry at 110°C, weigh).	Definitive	1. 0.05 pCi/g in accordance with QAPjP[b] 2. 0.05 pCi/g in accordance with QAPjP[b] 3. 0.05 pCi/g in accordance with QAPjP[b] 4. 0.05 pCi/g in accordance with QAPjP[b] 5. In accordance with QAPjP[b] 6. 0.5 pCi/g in accordance with QAPjP[b] 7. Variable, based on target compound in accordance with QAPjP[b] Table 1-2 8. 10 µg/L for extract analysis 9. 50 µg/L for extract analysis 10. 0.1 g.	Based on project objectives, underburden is not excavated but is exposed to allow sampling for radionuclides and some waste zone contaminants.
Characterize waste zone material for compliant onsite storage	Provide data on excavated waste zone material to meet storage INEEL WAC[d] and for future disposition.	1. Visual examination 2. Nitrates 3. Total metals 4. PCBs 5. VOCs 6. Semivolatile organic compounds 7. PCBs in liquid 8. Contact dose rate (beta+gamma+neutron) at container surface 9. Dose rate (gamma/ neutron) dose rate at 2 m from surface of container 10. Neutron contribution (at contact) 11. Container surface smearable alpha/beta contamination 12. Total cyanide 13. Weight of container 14. a. Transuranic activity (i.e., nCi/g) b. Pu-239 equivalent activity (i.e., PE-Ci) c. Pu-239 FGE d. Uranium isotopic masses (U-233, U-234, and U-238) e. Plutonium isotopic masses (Pu-238, Pu-239, Pu-240, and Pu-242) f. Am-241 mass g. Total fissile mass (U-233, U-235, and Pu-239) h. Nonfissile beta-gamma emitting radionuclides (Sr-90 and Cs-137).	1. Visual 2. a. composite sampling performed for all waste zone material b. bias sample based on visual recognition of yellow or white granular/crystalline material 3–6. Statistical number of grab samples will be collected and composited from the transfer carts, for 90% upper confidence level of the mean concentration 7. 100% visual inspection in glovebox, collect and analyze biased samples of free liquids when found 8-11. 100% container radiological survey 12. Visual; collect biased samples where pellets are seen (where concentrated cyanides are suspected) 13. NA 14. 100% drum assay will provide radiological characterization in conjunction with acceptable knowledge.	1. Visual 2. SW-846-9056[e] 3. SW-846-6010B[f]/7000A[g] 4. SW-846-8082[h] 5. SW-846-8260B[i] 6. SW-846-8270C[j] 7. Visual, SW-846-8082[h] 8-11. Radiological survey 12. SW-846-9012A[k] 13. Weigh drum 14. Nondestructive assay	Definitive, Screening, Health Physics Survey	1. NA 2. a. Consistent with method (0.1 mg/L for sample digestate) b. Consistent with method (0.1 mg/L for sample digestate) 3. Consistent with WIPP-certified laboratory protocol 4. Consistent with WIPP-certified laboratory protocol 5. Consistent with WIPP-certified laboratory protocol 6. Consistent with WIPP-certified laboratory protocol 7. 5 mg/kg 8. 0.5 mRem/hour 9. 0.5 mRem/hour 10. 0.5 mRem/hour 11. 200 dpm/100 cm^3 beta-gamma, or 20 dpm/100 cm^3 alpha 12. 1 mg/kg 13. NA 14. As achievable with current technology.	Specific criteria for the project are subject to change. 1. Visual examination will include INEEL WAC-prohibited items 2. a. Composite sample will be evaluated for nitrate concentration b. Bias sample will be evaluated based on the threshold value 3-6. Compositing strategy is detailed in the FSP[a] text 7. Free liquids will be stabilized with absorbent after sampling. WAC thresholds for container dose rates (Items 8-11) are: 8. 200 mRem/hour 9. 10 mRem/hour 10. 1 mRem/hour 11. 200 dpm/100 cm^2 beta-gamma, or 20 dpm/100 cm^2 alpha activity 12. If suspicious objects (e.g., pellet concentrations) are found in waste batches, additional measurements will be required 13. Density estimate to be calculated from noted weight and volume measurements.

Table 2. (continued).

Objective	Data Use	Measurement	Sampling Method	Analytical Method	Analytical Level	Required Detection Level	Comments and Rationale
Provide waste zone samples of interest to support contamination migration evaluations	Support subsurface migration evaluations and the OU 7-13/14 RI/FS	1. Differentiate between Series 741/742, Series 743 sludge, interstitial soil, and other waste zone material using - Color - Consistency	1. Biased samples of suspected Series 743 sludge, Series 741/742 sludge and interstitial soil will be collected based on the visual examination of waste zone material. Operations procedures will establish the criteria for differentiating Series 743 sludge, Series 741/742 sludge, and interstitial soil in waste zone material.	1. Visual based on the examination criteria	Screening	1. Not applicable	The project will collect up to 58 samples of visually identified Series 743 sludge, up to 13 samples of visually identified Series 741/742 sludge, and up to 36 samples of visually identified interstitial soil to support subsurface migration evaluations.
Monitor and record facility emissions and worker exposure.	Startup and operation authorization and assessing short-term risk information.	1. Facility air emissions in accordance with the "National Emission Standards for Hazardous Air Pollutants Monitoring of the OU 7-10 Glovebox Excavator Method Project (Draft)"[l] 2. Air-monitoring measurements from the OU 7-10 HASP[c] 3. Worker radiological monitoring records in accordance with the HASP.[c]				1-3. In accordance with referenced plans.	1-3. Does not impose or imply additional measurement requirements beyond what is required by safety and environmental regulations.

a. This document.
b. DOE-ID 2002a
c. INEEL 2003
d. INEEL 2000
e. EPA 1994b
f. EPA 1996a
g. EPA 1996b
h. EPA 1996c
i. EPA 1996d
j. EPA 1996e
k. EPA 1996f
l. DOE-ID 2002d

FGE = fissile gram equivalent
FSP = field sampling plan
HASP = health and safety plan
NA = not applicable
NESHAPS =National Emission Standards for Hazardous Air Pollutants
PCB = polychlorinated biphenyls
QAPjP = quality assurance project plan
VOC = volatile organic compound
WAC = waste acceptance criteria
WIPP = Waste Isolation Pilot Plant

2.1.4 Boundaries

The boundary of this characterization is the physical contents of the newly packaged drum population being characterized. Material type is limited to nondebris waste because, for the analyses required by this plan, debris waste may be characterized using acceptable knowledge (DOE 2001, Table B-1) and nondestructive assay. Other materials (e.g., small containers of liquids or solids) are outside the scope of this plan and will be evaluated on a case-by-case basis (see Section 3.2.6).

2.1.5 Decision Rules

The following statement addresses the decision rules for the soils and waste solids:

- If the upper 90% confidence limit (UCL_{90}) of the mean concentration of any contaminant is found (through total concentration analyses [as opposed to leachable concentration]) to be greater than 20 times the toxic characteristic leaching procedure threshold (EPA 1996a-f) (for which there has been no corresponding hazardous waste code applied by acceptable knowledge), then the decision rule would be to apply the appropriate characteristic waste code to the entire drum population.

- If the UCL_{90} of the mean concentration indicates the presence of PCBs is greater than or equal to 50 ppm, the decision rule is to designate the entire drum population as TSCA-regulated waste.

2.1.6 Sampling Design and Associated Decision Error

The retrieved soils and waste solids are considered a single population for characterization purposes. The basic sampling strategy is to perform composite sampling in the gloveboxes such that a single sample is composited to represent the contents of five newly packaged drums. Sample compositing is accepted as a means of estimating contaminant concentrations for relatively large populations because this procedure allows the contents of every newly packaged drum to be represented in the sampling scheme. In this case, characterization will involve a statistical analysis of the resulting contaminant concentrations allowing determination of the UCL_{90} of the mean concentration for all contaminants of interest. The mean concentration can only be determined after generation of data from the entire soils and waste solids population. The statistical methodology is consistent with that recommended by the Waste Isolation Pilot Plant (WIPP) in its Waste Analysis Plan (WAP) (DOE 2001). Because the samples are representative of the entire drum population, hazardous waste codes will be designated universally to the drum population.

2.2 Subpopulations of Soils and Waste Solids

2.2.1 Problem

Small subpopulations may be encountered during retrieval activities that could pose a safety concern during future processing or that would require additional analytical information to support proper hazardous waste or TSCA-based waste determinations. Evaluating these types of waste as distinct subpopulations was determined to be more appropriate than sampling the entire waste stream for the materials discussed below because visual characteristics make them separable for additional (i.e., biased) sampling. Biased sampling is subjective sampling and is typically influenced by key identifiable characteristics that are targeted for a sampling opportunity. These populations include the following categories:

- Soils and waste solids potentially containing nitrate-bearing waste

- Uncontainerized liquids potentially containing PCBs

- Pellets potentially containing cyanide
- Special-case or outlier waste, or unplanned sample collection opportunities.[d]

Biased sampling will be performed to determine if special precautions or waste determinations are needed for handling or storing the drums within these subpopulations.

2.2.2 Decisions

Characterization data from drums containing the subpopulations identified above will be used to support the following determinations:

- Whether subpopulations are present that cause the waste to be considered ignitable under the RCRA inclusion of U.S. Department of Transportation (DOT) oxidizers as characteristic waste
- Whether PCB liquids are present in the waste such that the waste would be regulated under TSCA (greater than or equal to 50 ppm)
- Whether concentrated cyanides (i.e., pelletized-type material detected during visual inspection) are present that would lead to the assignment of listed waste codes identified for sodium and potassium cyanide.

In addition, drums within these subpopulations will be included in the basic strategy described in Section 2.1. This means that the drums within these subpopulations would be sampled as part of the soils and waste solids waste stream; however, additional drum-specific samples would be collected and analyzed for the suspect contaminant (i.e., nitrates, PCBs, or cyanides) and the resulting decision could add to the characterization determined from the sampling of soils and waste solids.

2.2.3 Decision Inputs

The following inputs are needed for the determinations listed in Section 2.2.2:

- Characterization data, by drum
- Toxic Substances Control Act standards found in 40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions"
- Descriptions of RCRA characteristic and listed hazardous waste found in 40 CFR 261, "Identification and Listing of Hazardous Waste"
- Idaho National Engineering and Environmental Laboratory WAC.

2.2.4 Boundaries

The boundary of this characterization effort is the physical contents of each drum. For these subpopulations, sample results collected from each drum will apply only to the specific drum being

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d. It is important to note that other unanticipated situations may arise that are not described by this plan. In this case, a team involving management, operations, safety, radiological control, sample management and laboratory personnel may decide to analyze additional samples to help the project resolve an issue.

characterized. However, the characterization results from the general soils and waste solids population also will be applied to these subpopulations because the contents also will be included in that sampling effort.

2.2.5 Decision Rules

The following bulleted items address the determination rules for the subpopulations described in Section 2.2.1:

- If nitrate-based visual screening described in Section 3.2 indicates the probable presence of nitrate-bearing waste, then representative samples will be collected to characterize the drum of interest. The samples will be analyzed by ion chromatography to determine nitrate concentrations. If characterization data are greater than the identified respective action levels, then assignment of a D001 for ignitability may be made, as appropriate.

- If samples from uncontainerized liquids indicate the presence of PCBs greater than or equal to 50 ppm, then the corresponding drum will be designated and regulated as TSCA waste and identified to contain contents that had contained free liquids with PCBs greater than or equal to 50 ppm.

- If analytical results indicate pellets are cyanide based, the drummed waste would be considered to contain discarded or off-specification chemical products and would be considered P098 or P106 hazardous waste for potassium cyanide or sodium cyanide, respectively.

2.2.6 Sampling Design and Associated Decision Error

Results of the bias sampling will only be used to characterize the contents of each drum being sampled.

2.3 Quality Assurance Objectives for Measurement

The quality assurance (QA) objectives for measurement will meet or surpass the minimum requirements for data quality indicators established in the QAPjP (DOE-ID 2000). This reference provides minimum requirements for the following measurement quality indicators: precision, accuracy, representativeness, completeness, and comparability. Precision, accuracy, and completeness will be calculated in accordance with the QAPjP.

2.3.1 Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. In the field, precision is affected by sample collection procedures, the natural heterogeneity in the soil, and the unknown and potentially extreme heterogeneity of the buried waste. Overall precision is estimated by the variability (i.e., standard deviation) across all regular samples within a population. This value then can be used to calculate the upper confidence bounds of the applicable mean concentrations. The compositing approach used to collect most samples described in Section 3 is expected to reduce the overall variability in measured values (thus helping to improve the precision for the given number of samples being analyzed).

Overall precision (field and laboratory) evaluations can be supported by collecting duplicate samples in the field. Laboratory precision will be based on the use of laboratory-generated duplicate samples or matrix spike and matrix spike duplicate samples. Evaluation of laboratory precision will be performed during the process of method data validation. For this project, field precision will be based on analysis of collocated field duplicate samples. Results of these can be used to evaluate local variability. Field duplicates will be collected at a minimum frequency of one duplicate per 20 regular samples.

2.3.2 Accuracy

Accuracy is a measure of bias in a measurement system. Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Laboratory accuracy is demonstrated using laboratory control samples, blind quality control (QC) samples (not planned as part of this investigation), and matrix spikes. Evaluation of laboratory accuracy will be performed during the method data validation process. Sample preservation and handling, field contamination, and the sample size and matrix affect overall accuracy. The representativeness of the sample (discussed below) also is a factor in the overall accuracy of the result. Sampling activities may require removal of larger pieces during collection (e.g., rock pebbles). If larger geologic media are removed, it is anticipated that a bias could result indicating higher reported concentrations than true concentrations.

2.3.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which the sampling and analysis data accurately and precisely represent a characteristic of a population, the parameter variations at a sampling point, or an environmental condition. In addition, representativeness addresses the proper design of the sampling program. The representativeness criterion will be satisfied by confirming that sampling locations are properly selected and a sufficient number of samples are collected to meet the required confidence level. It should be noted that when sampling heterogeneous materials like waste, the aliquot selected for analysis may or may not be representative of a large portion of the total waste population. To mitigate this problem, most samples originating from the waste zone are composited and then homogenized before aliquot collection at the analytical laboratory. Finally, homogenized samples will be representative of the sampled population (that originating from within the project excavation), but will not necessarily be representative of the remainder of the waste in OU 7-10 or other disposal units in the SDA because that waste comes from different time periods and additional sources.

2.3.4 Detection Limits

Detection limits will be less than or equal to the decision-based concentrations for the contaminants of interest. Detection limits are specified in the QAPjP for core samples and will be specified in task-order statements of work for waste zone samples.

2.3.5 Completeness

Completeness is a measure of the quantity of usable data collected during an investigation. The QAPjP requires that an overall completeness goal of 90% be achieved for noncritical samples. If critical parameters or samples are identified, a 100% completeness goal is specified. Critical data points are those sample locations or parameters for which valid data must be obtained for the sampling event to be considered complete.

For this project, biased samples collected from material assumed to contain nitrate-bearing waste will be considered critical for evaluation of the potential for ignitability of the waste. This critical sample designation is required because ignitable materials could invoke specific storage requirements. If valid data are not generated, then the material in question will require resampling, or will be conservatively classified as ignitable. All other project samples will be considered noncritical, with a completeness goal of 90%.

2.3.6 Comparability

Comparability is a qualitative characteristic that refers to the confidence with which one data set can be compared to another. The analytical procedures used for characterization are standard and will be comparable to those procedures historically followed by other programs.

2.4 Data Validation

Method data validation is the process whereby analytical data are reviewed against set criteria to ensure that the results conform to the requirements of the analytical method and any other specified requirements. All laboratory-generated analytical data will be validated to Level A as described in INEEL Guide (GDE) -7003, "Levels of Analytical Method Data Validation." Level A validation is the most stringent validation level requiring review of all laboratory QA and QC (QA/QC) data, as well as raw data generated as the result of the analytical process. All other laboratory-generated analytical data will be reviewed for analytical method compliance and technical merit.

3. SAMPLE LOCATION AND FREQUENCY

Project activities will focus on three horizons or zones during the project. These are designated as the overburden soil, the waste zone material, and the underburden soil. The overburden soil was placed over waste as a barrier and the waste zone material comprises the waste and associated interstitial soil. The underburden soil is predominantly native soil left in place during the original pit excavation and lies beneath the waste zone material and above the underlying basalt bedrock.

3.1 Overview of Waste Retrieval Process

Detailed project operations and removal strategy are currently being finalized. The following presents an overview of the retrieval approach to enable sampling activities to be placed in context. The first phase of removal activities involves removal of the overburden soil. This soil is assumed to be uncontaminated and will be removed to a predetermined depth (approximately 3.5 ft), then segregated before excavation of waste zone materials. Sampling of the overburden, if required, is outside the scope of this FSP.

All waste zone materials will be retrieved inside the RCS, which is located within the Weather Enclosure Structure (see Figure 4). The excavator arm contained within the RCS excavates a semicircular swath of waste zone material. Approximately 75 to 125 yd^3 of waste zone material and interstitial soil will be retrieved from the RCS area. The excavator bucket will place waste zone material in transfer carts of 2.5 ft^3 nominal volume. The carts will transport waste zone material through gloveboxes (see Figure 5) that are within the Packaging Glovebox System (PGS), where the material is inspected, segregated (if necessary), and sampled. Each of three gloveboxes in the PBS is equipped with three drum bagout stations for packaging the material into 55- and 85-gal drums. Following exposure of the underburden surface, core sampling of underburden soil will be conducted. The waste streams in the retrieval area consist of the RFP Series 74 sludge, graphite molds, combustible and noncombustible waste, empty contaminated drums, and interstitial soils (see Table 1 for details on waste types and associated compositions).

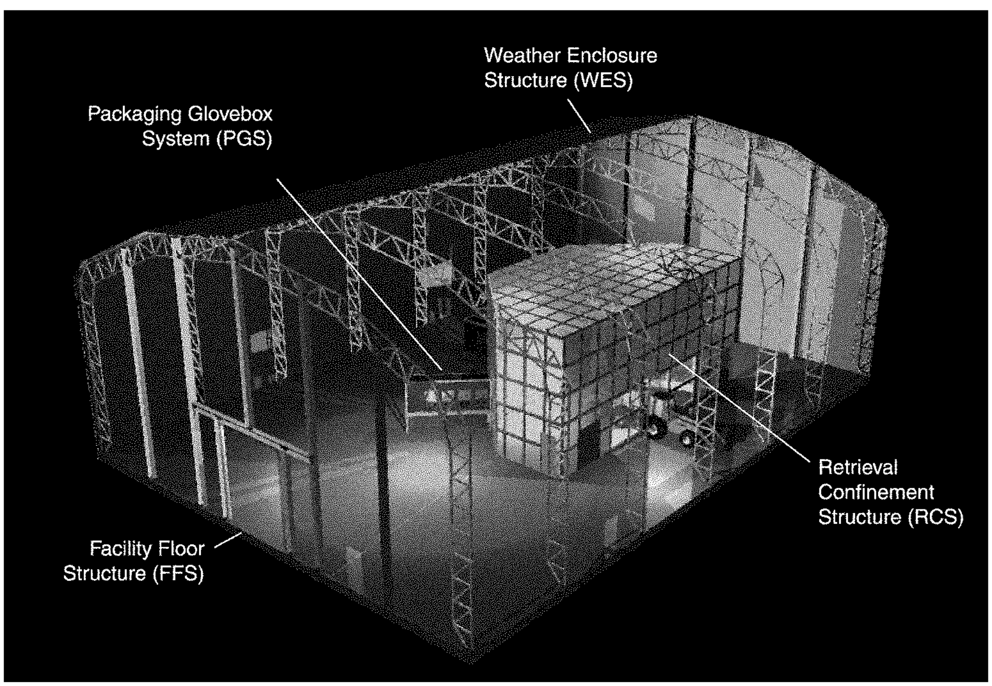

Figure 4. Facility layout of the OU 7-10 Glovebox Excavator Method Project.

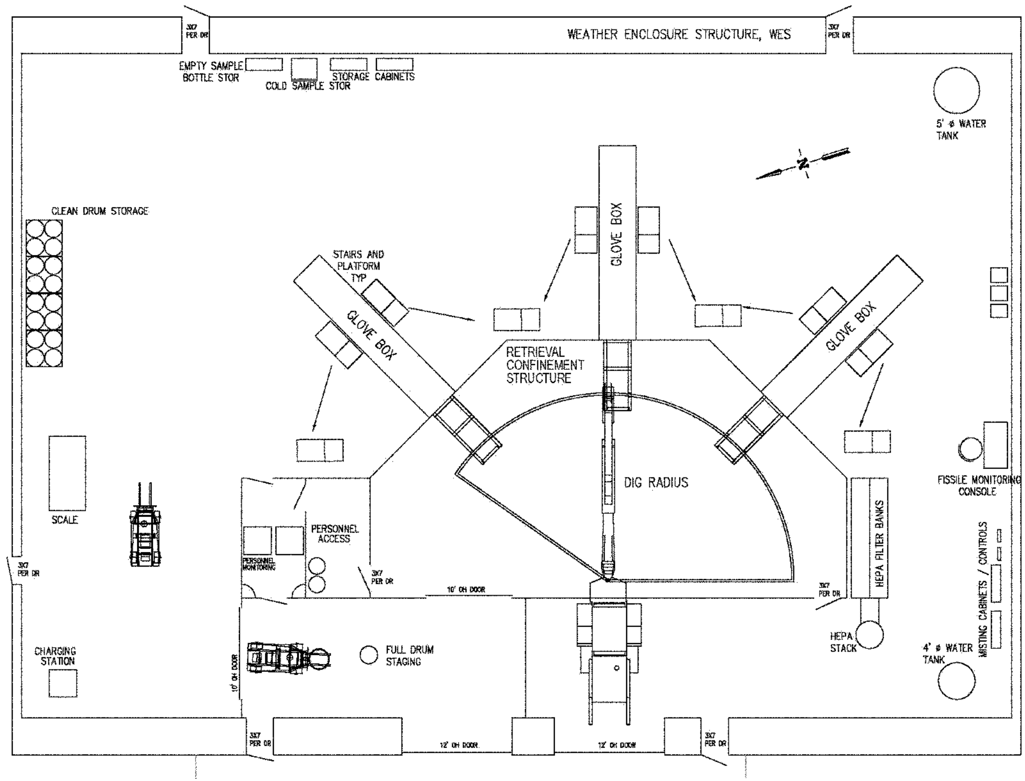

Figure 5. Weather Enclosure Structure housing the Retrieval Confinement Structure and the glovebox operations.

The following sections address the location and sampling frequency of waste zone materials and underburden core samples. Section 5 describes the collection and frequency of QA/QC samples in support of this project.

3.2 Waste Zone Material Sampling

This section details the location and frequency of samples collected from waste zone material. It specifically addresses the following groups:

- Soils and waste solids
- Nitrate-bearing waste
- Uncontainerized liquids potentially containing PCBs
- Pellets that may contain cyanide
- Special-case or outlier waste.

Table 1 identifies waste forms that are expected to be recovered from OU 7-10 during the project. Using guidance from the WIPP-WAP (DOE 2001), characterization requirements are specified on a waste stream basis. The WIPP-WAP defines a waste stream as "...waste material generated from a single process or from an activity that is similar in material, physical form, and hazardous constituents" (p. B-2). Numerous processes were involved in the original generation of OU 7-10 waste originating from RFP.

However, retrieval activities conducted during the OU 7-10 Glovebox Excavator Method Project are considered to result in a new, single generation process. The predominant waste stream generated by volume is expected to be soil (Walsh 2002). This characterization results in assignment of a Waste Matrix Code Group of "Soil." Other waste matrix code groups include solidified inorganics, solidified organics, salt waste, lead/cadmium metal, and uncategorized metal. Categorization of the waste into specific categories would be complex and impractical because of (1) the expected condition of the original waste containers, (2) the inevitable mixing of the waste during retrieval, (3) the inconsistent visual fingerprints of the waste caused by inconsistencies within the original waste forms and different states of oxidation of the waste, and (4) the limited availability of screening devices.

During project retrieval activities, rudimentary segregation will be conducted. The following discussion describes the expected categories applicable to classification of waste-zone material. The waste streams encountered may include the following:

- **Soils and gravel (Summary Group S4000)—**This is expected to be the predominant waste stream encountered or retrieved and includes (in total waste stream volume) more than 50% soils and gravel with the bulk of the remaining material being waste material that, by itself, would be considered homogenous solids (i.e., Summary Group S3000). For the purposes of this plan, the sampled portion of this material is also called soils and waste solids. Within this group are three subpopulations. The first is a possible nitrate-bearing waste that will be sampled in a biased manner for total nitrates to evaluate against action levels (to be developed) to determine if this subpopulation is ignitable. The second is an additional characterization step required when uncontainerized liquids are encountered. The third are pellets potentially containing cyanides. The approach to sampling this waste, including location of subsamples and frequency of collection, is described in Section 3.2.1.

- **Debris waste, (Summary Group S5000)—**Physical samples are not required to be collected from this waste stream and the waste will be segregated to the extent practicable.

3.2.1 Sampling Soils and Waste Solids

The sampling approach used for the soils and waste solids waste stream will be to obtain samples representative of the waste population. The approach balances cost and operational constraints with the requirement to produce representative data.

The sampling process requires the collection of small incremental subsamples from each cart used to fill each drum in a five-drum campaign. Subsamples from all carts used to fill five drums are composited into one sample representing the five-drum campaign. Figure 6 graphically depicts this approach, which includes the following:

1. The operator will collect one subsample from each cart used to fill a drum. This subsample will include the major soil and waste components in the cart planned for addition to the waste drum being filled. This could include oily sludge, cemented sludge, soil, and graphite. The operator will include fractions from up to five principal soil and waste components of the cart. The determination of what incremental fractions to collect will be made by the operator based on a visual estimate of the waste types and their distribution by volume in the cart. The operator will use best professional judgment in making this determination. It is not expected to require extensive time or physical activity (digging through) to determine how to collect this representative subsample.

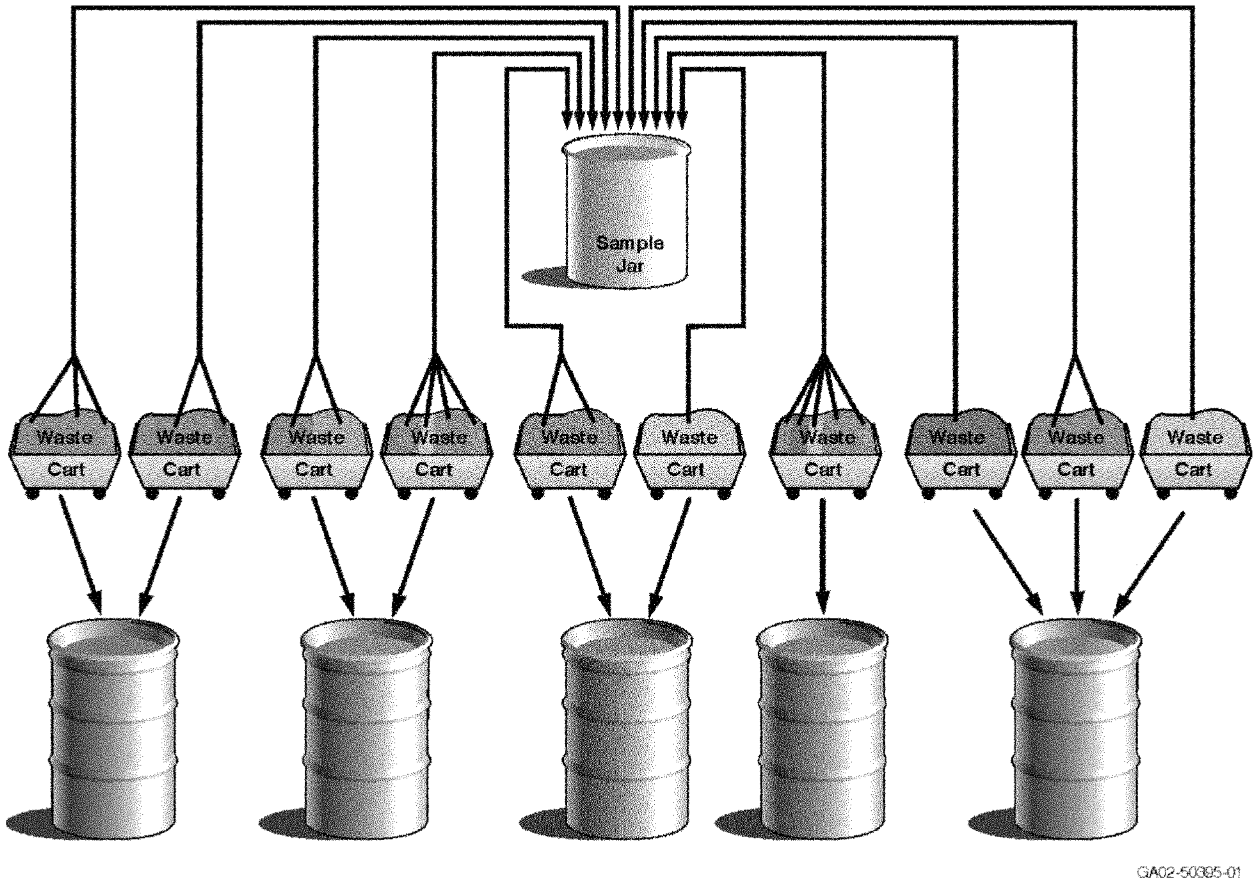

Figure 6. Depiction of sampling approach used for soils and waste solids.

2. After collection, the operator will place the subsample in a sample jar and close the jar lid until the next subsample is added to the jar (as required).

3. The operator will repeat this procedure on both carts used to fill a drum and on all carts filling drums in a five-drum (maximum) sampling campaign. In cases where only one, or three or more carts, are used to fill a drum, the operator will collect subsamples from each cart using the method described in Step 1. In these cases, the operator will record the adjusted number of carts and subsamples on the log sheet for the sample.

Samples collected using this approach will undergo gamma spectroscopy nondestructive assay and then will be analyzed for volatile organic compounds (VOCs), semivolatile organic compound (SVOCs), PCBs, metals, and total nitrates. Analyses will be consistent with WIPP-based protocol. A summary of relevant sampling information, including the approximate number of samples planned, analytical suites, proposed methods, and sample container types, is given in Table 3. This table includes the samples described in this section and those contained in the rest of this chapter.

3.2.1.1 Statistical Rationale and Analysis Method. The purpose of the statistical analysis of the data collected is to calculate UCL_{90} for the population means and compare them to regulatory thresholds to determine if hazardous waste codes should be assigned. This is done in accordance with methods described in Part B-2 of the WIPP-WAP (DOE 2001).

As a preliminary step, the data will be checked for normality using the Shapiro-Wilk W statistic. Sufficiently small values of the W statistic lead to rejection of normality. Should this occur, transformations of the data by natural logarithm and square root will be performed. The transformation resulting in the largest W statistic will be the one chosen for subsequent analyses. All of the data for a contaminant will undergo this transformation and the UCL_{90}s will be calculated based on these transformed data. The regulatory thresholds will likewise be transformed so that comparisons can be made and hazardous waste codes assigned. The normality evaluation is an additional step, not required by the WIPP WAP, but is deemed important and is technically defensible.

The upper UCL_{90} for the mean concentration of each contaminant is calculated as given in Equation (1).

$$UCL_{90} = \bar{x} + \frac{t_{\alpha,n-1}s}{\sqrt{n}} \tag{1}$$

where

$\bar{x}$ = sample mean

$t_{\alpha,n-1}$ = the tabled value of student's t corresponding to 90% confidence level and n-1 degrees of freedom

s = represents the standard deviation of the sample data

n = sample size.

The interpretation of the UCL_{90} is that the project can be 90% confident that the population mean is less than the UCL_{90}. If the UCL_{90} is less than the regulatory threshold, then the project has demonstrated with at least 90% confidence that the population mean is less than the regulatory threshold.

It should be noted that the sampling strategy described previously will result in a very accurate estimate of the population mean because every drum contributes to the estimate by contributing to a five-drum composite.

The following subsections describe additional sampling approaches for subpopulations within the soils and waste solids. This includes additional biased sampling for nitrates and other constituents if visual indications warrant.

3.2.2 Sampling Soils and Waste Solids Potentially Containing Nitrate-Bearing Waste

In addition to the sampling approach described for soils and waste solids above, biased samples may be collected of this waste stream based on visual screening results for the potential presence of nitrate-bearing waste. Nitrate waste may be considered oxidizers under DOT regulations (49 CFR 173.151, "Exceptions for Class 4"). These DOT oxidizers are considered characteristically hazardous waste under RCRA.

Screening will be used as the first step to identify the presence of high concentrations of nitrates in the waste zone material. All retrieved waste zone material will be visually screened for the presence of material assumed to contain nitrates. Waste from any cart containing what appears to be Series 745 (nitrate-bearing) sludge will contribute to a sample representing a newly filled drum. It is assumed that

Table 3. Sample target and analytical parameters summary information for waste zone samples and underburden cores.

Sample Target	Sample Identification Prefix (see Section 4)	Approximate Number of Samples (including quality control)	Analytical Method(s)	Analytes or Analyte Groups	Recommended Container	Preservative	Most Restrictive Holding Time
Soils and waste solids	P9GW	125	SW-846 Method 8015B SW-846 Method 8260B SW-846 Method 8270C SW-846 Method 8082 SW-846 Method 6010B and 7000 series SW-846 Method 9056 (ion chromatography) Gamma spectroscopy	VOCs (WIPP list) VOCs (WIPP list) SVOCs (WIPP list) PCBs Metals (WIPP list) Nitrate Gamma-emitting isotopes	250-ml wide-mouth clear glass jar with Teflon lined lid (I-Chem 320 0250 or equivalent).	Cool, 4°C	14 days until analysis (for VOCs)
Possible nitrates from soils and waste solids	P9GN	0 to 32	SW-846 Method 9056 (Ion chromatography)	Nitrate	250-ml glass jar with Teflon lined lid (I-Chem 320 0250 or equivalent.	Cool, 4°C	28 days
Possible PCB liquids from soils and waste solids	P9GL	0 to 32	SW-846 Method 8082	PCBs	250-ml clear glass jar with Teflon lined lid (I-Chem 320 0250 or equivalent).	Cool, 4°C	7 days until extraction, 40 days after extraction
Possible cyanide pellets from soils and waste solids	P9GM	0 to 5	SW-846 Method 9012A	Total and amenable cyanide	250-ml wide mouth clear glass with Teflon lined lid (I-Chem 320 0250 or equivalent).	Cool, 4°C	14 days
Organic sludge grabs (Series 743 type sludge) for OU 7-13/14	P9GR	58	SW-846 Method 8260B SW-846 Method 8270B Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy	VOCs SVOCs Pu-239/240 Am-241 Np-237 U-234, 235/236, 238	250-ml wide-mouth clear glass jar with Teflon lined lid (I-Chem 320 0250 or equivalent).	Cool, 4°C	NA[a]
Cemented sludge grabs (Series 741/742 type sludge) for OU 7-13/14	P9G?	13	Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy SW-846 Method 6010B and 7000 series, or Method 6020	Pu-239/240 Am-241 Np-237 U-234, 235/236, 238 Metals	250-ml wide-mouth clear glass jar with Teflon lined lid (I-Chem 320 0250 or equivalent).	Cool, 4°C	NA[a]
Interstitial soils for OU 7-13/14	P9G?	36	Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy SW-846 Method 6010B and 7000 series, or Method 6020 SW-846 Method 9060 (or equivalent)	Pu-239/240 Am-241 Np-237 U-234, 235/236, 238 Metals Carbon (from graphite)	250-ml wide mouth clear glass jar with Teflon lined lid (I-Chem 320 0250 or equivalent).	Cool, 4°C	NA[a]

Table 3. (continued).

Sample Target	Sample Identification Prefix (see Section 4)	Approximate Number of Samples (including quality control)	Analytical Method(s)	Analytes or Analyte Groups	Recommended Container	Preservative	Most Restrictive Holding Time
Special-case waste samples	P9GM	0 to 5	TBD[b]	TBD[b]	TBD[b]	TBD[b]	TBD[b]
Interstitial soils for EPA	P9GM	0 to 10	Per EPA	Per EPA	2 x 250-ml wide mouth clear glass jar with Teflon lined lid (I-Chem 320 0250 or equivalent) Note: EPA may transfer to Marinelli containers.	None required (for radionuclide analyses)	6 months
Underburden cores	P9GU	Six cores segmented into 4-in.-long subsamples.	Gamma spectroscopy	Gamma-emitting Isotopes	Capped and taped Lexan core sleeve—segmented and subsampled in the laboratory.	Cool, 4°C	14 days until analysis (for VOCs)
			Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy Alpha spectroscopy	Am-241 Np-237 Pu Isotopes U Isotopes Ra-226			
			Inductively coupled plasma	Ca, Mg, Sr, Na, K, Fe, Mn, Cr			
			Ion chromatography	Cl, F, Br, NO3-N, NO2-N, Ortho-P			
			Gravimetric	Water content			
			SW-846 Method 8260B	VOCs			

EPA = U.S. Environmental Protection Agency
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
TBD = to be determined
VOC = volatile organic compound
WAG = waste area group
WIPP = Waste Isolation Pilot Plant

a. Holding times are not applicable because analysis results are intended to give beginning or baseline contaminant levels before any studies are performed.

b. Special case waste encountered in the glovebox will be addressed on a case-by-case basis.

concentrated nitrate salts would have a yellow or white granular or crystalline appearance, or possibly be in flake form. Only material from carts with these visual characteristics of concentrated nitrate-bearing waste will be collected for the biased sample. The sample will represent (proportionally) both suspect and nonsuspect material. Nonsuspect material (e.g., soil and other waste) would contribute to the sample in the approximate proportion that they exist compared to the suspect nitrate-bearing material in the cart. The samples will be analyzed for nitrates by ion chromatography.

The project will designate critical samples as those collected for ignitability evaluation purposes on drums for which visual screening indicated the likelihood of nitrates. If valid data are not generated, the material in question is expected to be conservatively classified as ignitable.

3.2.3 Sampling Uncontainerized Liquids Potentially Containing Polychlorinated Biphenyls

Sludges entering the glovebox with a liquid-like character (i.e., that flow at room temperature, or otherwise meet the definition of liquid in TSCA [40 CFR 761.3, "Definitions"]) will have the liquid fraction sampled and analyzed for PCBs, provided a minimum sample volume of 100 mL can be collected. The SW-846 guidance suggests a 1-L sample volume for solvent extraction of the sample (EPA 1996a-f); however, the INEEL laboratories only require 100-mL sample volume if radiological concerns are present. This volume also will allow quantification below the regulatory threshold. If multiple pools of liquid exist in the cart, the sample will contain representative fractions from each pool, as practical. Sampling will be performed before any operationally required stabilization activities. Analyses of these samples will be used to determine the as-found PCB concentration, if any. If contents from several carts are used to fill a single drum, and more than one cart contains free liquids, then samples of the free liquid will be collected from each cart and the sample analysis results associated with the drum will be combined during data analysis. If sample analysis confirms the as-found PCB concentration to be greater than or equal to 50 ppm, operations shall identify the drum as TSCA waste that contains free liquids greater than or equal to 50 ppm. Results of the PCB analyses will be used to characterize only the contents of the drum from which waste was sampled.

3.2.4 Sampling Pellets Potentially Containing Cyanide

Biased samples will be collected for total cyanide analysis where the presence of concentrated cyanides is suspected (uncontainerized pellet type material detected during visual inspection). Encountering a small amount of cyanide-based pellets is possible during retrieval activities. Before 1969, two 25-lb bags of cyanide pellets were buried in the SDA. No documentation exists to indicate where in the SDA the bags were buried, but the OU 7-10 area is a possibility. The pellets were distributed in Series 742 sludge drums. If uncontainerized pellets are discovered, a hazardous waste determination would be required. If pellets are encountered, biased samples will be collected and analyzed to determine cyanide presence. These samples will be collected for every newly packaged drum in which suspect pellets are disposed. If analytical results indicate the pellets were cyanide based, the drummed waste would be considered to contain discarded or off-specification chemical products and would be considered P098 or P106 hazardous waste for potassium cyanide or sodium cyanide, respectively.

3.2.5 Sampling to Support Requests from the Operable Unit 7-13/14 Project

Up to 58 regular samples are expected to be collected from what appears to be Series 743 organic sludge material. Up to 13 samples are expected to be collected of what appears to be Series 741/742 sludge material. Up to 36 regular samples are expected to be collected from what appears to be interstitial soil. Analysis of these samples will be funded by the OU 7-13/14 Project because the results are not required for OU 7-10 Project objectives.

These samples will be collected as biased grabs from the freshest material believed to be least affected by retrieval activities. To support this effort, the sludge sample material will come from as close as possible to the central mass of sludge originating from a buried drum. Visual characteristics will be used to identify the candidate material for sampling. Multiple samples can be collected from the same cartload of material.

During processing at RFP, the Series 743 organic waste was mixed with calcium silicate forming a grease or paste-like appearance (Clements 1982). Small amounts of Oil-Dri absorbent also were typically mixed with the waste. The waste is expected to exhibit colors ranging from brownish green to green to yellow. As indicated by Table 1, over 80% of the sludge-containing drums encountered during retrieval activities are anticipated to contain Series 743 sludge.

The Series 741 and 742 liquid waste was treated during processing at RFP to precipitate plutonium and americium from the waste. The precipitate or slurry was filtered to produce a sludge containing 50 to 70% water by weight and Portland cement was added to ensure absorption of any free liquids that might be formed from the sludge (Clements 1982). Small amounts of Oil-Dri absorbent also were typically mixed with the waste. The waste is expected to exhibit colors ranging from reddish to dark grey to black.

Interstitial waste zone soil will be sampled in a biased manner to exclude any visually obvious sludge, graphite, or debris waste within the sample. To make this determination, project personnel will visually examine waste zone material after it is placed in a transfer cart and enters the glovebox. Multiple samples can be collected from the same cartload of material. When an interstitial soil sample is collected for the EPA (as described in 3.2.7), a collocated sample will be collected for the OU 7-13/14 Project. If no samples are collected for the EPA, as outlined in Section 3.2.7, interstitial soil samples will still need to be collected to complete the 36 requested samples.

3.2.6 Special-Case Waste, Outlier Waste, or Unplanned Sample Collection Opportunities

During complex remediation activities, all possible scenarios that could benefit from the collection of characterization data cannot be evaluated. The project will always perform within its operational constraints. However, it may be required that samples not described by this plan be collected. If warranted by the situation, additional samples may be collected using the framework of this plan. A team involving management, operations, safety, radiological control, sample management, and laboratory personnel may determine how, what, where, and for what purpose to analyze additional samples required to aid the project in resolving an issue. The decision process will be fully documented. Sample-handling procedures (e.g., custody requirements) will be maintained in accordance with this plan. Authorization to proceed with the collection and analysis of unplanned samples will be determined by management.

3.2.7 Sampling Interstitial Soil for the Agencies

The EPA has provided a logic diagram for obtaining samples from the waste zone for turnover to the EPA (see Figure 7). The project will use the logic from this diagram in endeavoring to obtain samples, as described below.

When the excavator operator encounters and identifies candidate waste (i.e., sludge, graphite, or debris) from a breached drum, project personnel will note the corresponding location. During subsequent excavation below the breached drum, the interstitial waste zone soil (if present and clearly identifiable as such) will be sampled in a biased manner to exclude any visually obvious sludge, graphite, or debris waste within the sample. To make this determination, project personnel will visually examine waste zone material after it is placed in a transfer cart and enters the glovebox. Up to 10 samples will be obtained in this manner for transfer to the Agencies (i.e., EPA and Idaho Department of Environmental Quality). These samples will be collected only to the extent that clearly evident interstitial waste zone soil is located beneath a breached drum. In instances where these samples are collected, collocated samples also will be collected for the OU 7-13/14 Project.

It must be noted that this sampling will be performed on a best efforts basis, but that various factors exist that may compromise sample integrity. These factors include the following:

- Natural mixing that will occur during the excavation process
- Material sloughing from the side walls, which will increase with depth of excavation
- The high possibility for cross-contamination as a result of mixing, sloughing, and material handling.

No provisions for cleaning or decontaminating the excavator's end effector, transfer carts, or gloveboxes will be available during the retrieval of waste zone material. Therefore, cross-contamination between successive excavation activities is a possible and unavoidable outcome during waste retrieval operations.

3.3 Underburden Core Sampling

The project will collect cores of underburden soil to evaluate contaminant migration below buried waste. Operational requirements may determine when during the excavation process core samples will be collected. Following removal of waste and interstitial soil from a portion of the waste zone, the bottom of the excavation in that area will be readied for underburden core sampling. Operable Unit 7-13/14 Project personnel may assist in determining that excavation has reached the underburden depth. The area will be verified to be essentially free of visible waste-form material, though not necessarily stained underburden soil. Five cores and one duplicate location will be sampled for project evaluation.

3.3.1 Core Locations

The size of the excavation bottom is expected to be 40 ft^2 following completion of excavation activities. The relatively small surface of the exposed underburden, the estimated depth of the underburden, and the presence of existing probes influenced the proposed placement of cores.

The final exposed underburden surface will be somewhat fan shaped, forming an arc of approximately 110 degrees. For sampling purposes, this fan was divided into five sectors of approximately 22 degrees each (see Figure 8). Samples will be collected from each sector.

Within most sectors, preference was given to selecting locations that contained deeper underburden soil as indicated by interpreted results from previous probing activities.[e] This approach allows collection of cores over the extent of the excavation bottom, but with a preference toward more core recovery (core thickness) at each location. Figure 8 presents the proposed location of each core while Table 4 indicates the anticipated underburden depth in the vicinity of the core.

If special conditions (e.g., highly stained soil) are observed in an area of a sector not planned for coring, the core location from that sector is expected to be adjusted to target coring through the stain.

The core (P9-CORE-5A) from the furthest north sector will be collected as close as possible to an existing probe labeled P9-20. The project has identified this area as a target site for coring because of the elevated plutonium activity detected during logging of Probe P9-20. The potential for higher

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e. INEEL, 2000, "OU 7-10 Stage I Subsurface Exploration and Treatability Studies Report (Draft), Initial Probing Campaign (December 1999–June 2000)," INEEL/EXT-2000-00403, INEEL.

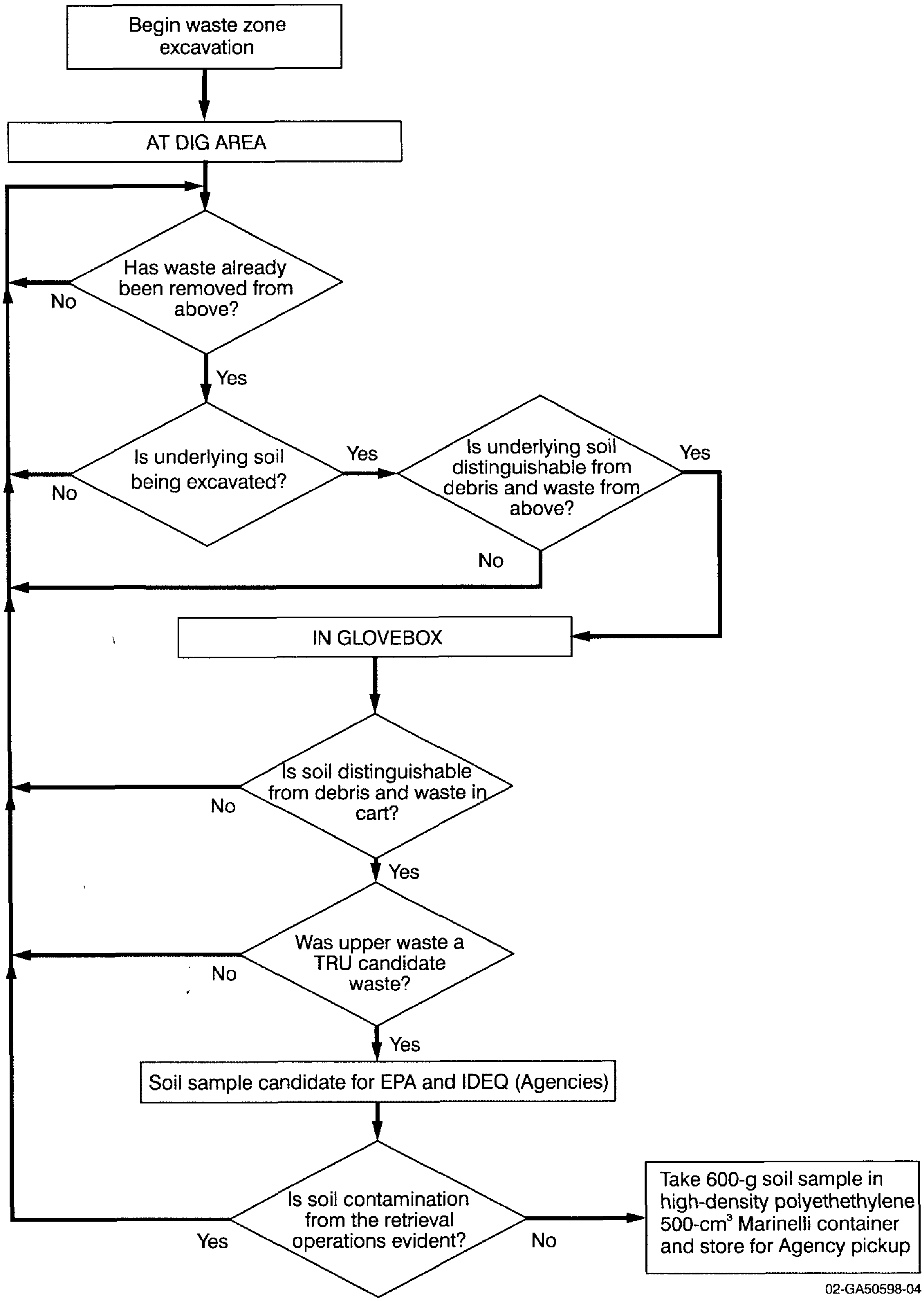

Figure 7. Logic diagram used to obtain interstitial soil samples from the waste zone for the U.S. Environmental Protection Agency.

contamination associated with P9-20 lead to selection of this sector to site a duplicate (collocated) core (P9-CORE-5B).

3.3.2 Locating Cores

Cores will be located using a position monitor equipped to the excavator in conjunction with visual reference points placed around the perimeter shoring box of the excavation. A position monitor will provide the horizontal reach (radius [r]) and vertical displacement (depth [d]) of the excavator's end effector (i.e., a hydraulic hammer used to support coring). The visual reference points provide the angle (theta [θ]) at which the boom's swing arc is positioned. The "r, θ, d" positioning system allows description and location of any point within the excavation-based reference system. Tying the origin of the excavator swing arm (the pivot point) to a surveyed location, along with another angular reference point (e.g., the 0-degree marker on the shoring box) allows integration of the local coordinate system to the RWMC Site Specific or State Plane Coordinate System. Table 4 indicates proposed positions of each core based on this locating system.

Because the operator is set back approximately 7.5 ft from the pivot point, the apparent angle seen by the operator to locate a specific point is often different than the true angle which originates through the pivot point. To aid in locating the cores as close to the planned locations as possible, an apparent angle is given in Table 4. This apparent angle or apparent θ is what the operator would see and correlate to a line running through the center of the proposed core location from the pivot point. In addition, OU 7-13/14 Project personnel may adjust the core location within approximately 6 in. of the location given in Table 4.

Table 4. Underburden core sample location information.

Core Name	Radius (r) from Pivot Point (origin) ± 0.5 ft (ft)	Approximate True θ ± 5 (degrees)	Approximate Apparent θ ± 5 (degrees)	Anticipated Depth Range (ft)	Anticipated Number of Intervals Sampled at Laboratory
P9-CORE-1	10.5	37	59	11 to 12.5	3+
P9-CORE-2	8.0	52	70	11 to 13	6
P9-CORE-3	9.5	72	80	11 to 16	13+
P9-CORE-4	14.0	95	93	11 to 15	12
P9-CORE-5A	12.0	117	107	11 to 12.5	3+
P9-CORE-5B	11.5	117	107	11 to 12.5	3+ (QC duplicates)

QC = quality control

3.3.3 Length of Core Samples and Further Sectioning of Core

The project estimates that the excavation will proceed to 11 ft deep (OU 7-10 Project Excavation Plan [Jamison and Preussner 2002]). Below 11 ft, the underburden is expected to be between 1.5 and 5 ft thick in the excavation area. The core retrieval design allows for core recoveries by inserting a sample tube to refusal or a depth of 4.5 ft, whichever occurs first. It should be noted that the soil column collected in the sample tube may be compacted as part of the sampling process. Consequently, insertion of the sample tube to a depth of 4.5 ft, or to refusal, may result in a sample core length less than the insertion depth. This is an acceptable result. Extracted cores will be capped, sealed, and labeled to indicate orientation such that:

- **Top**—Indicates side of core originating near the waste zone-underburden contact
- **Bottom—**Indicates portion of core originating near the contact with bedrock, refusal, or the end of the 4.5-ft core interval.

Following transfer to the analytical laboratory, cores will be cut into 1-ft-long sections, the ends will be covered with a Teflon sheet and capped with a plastic end cap and sealed, the cut sections clearly

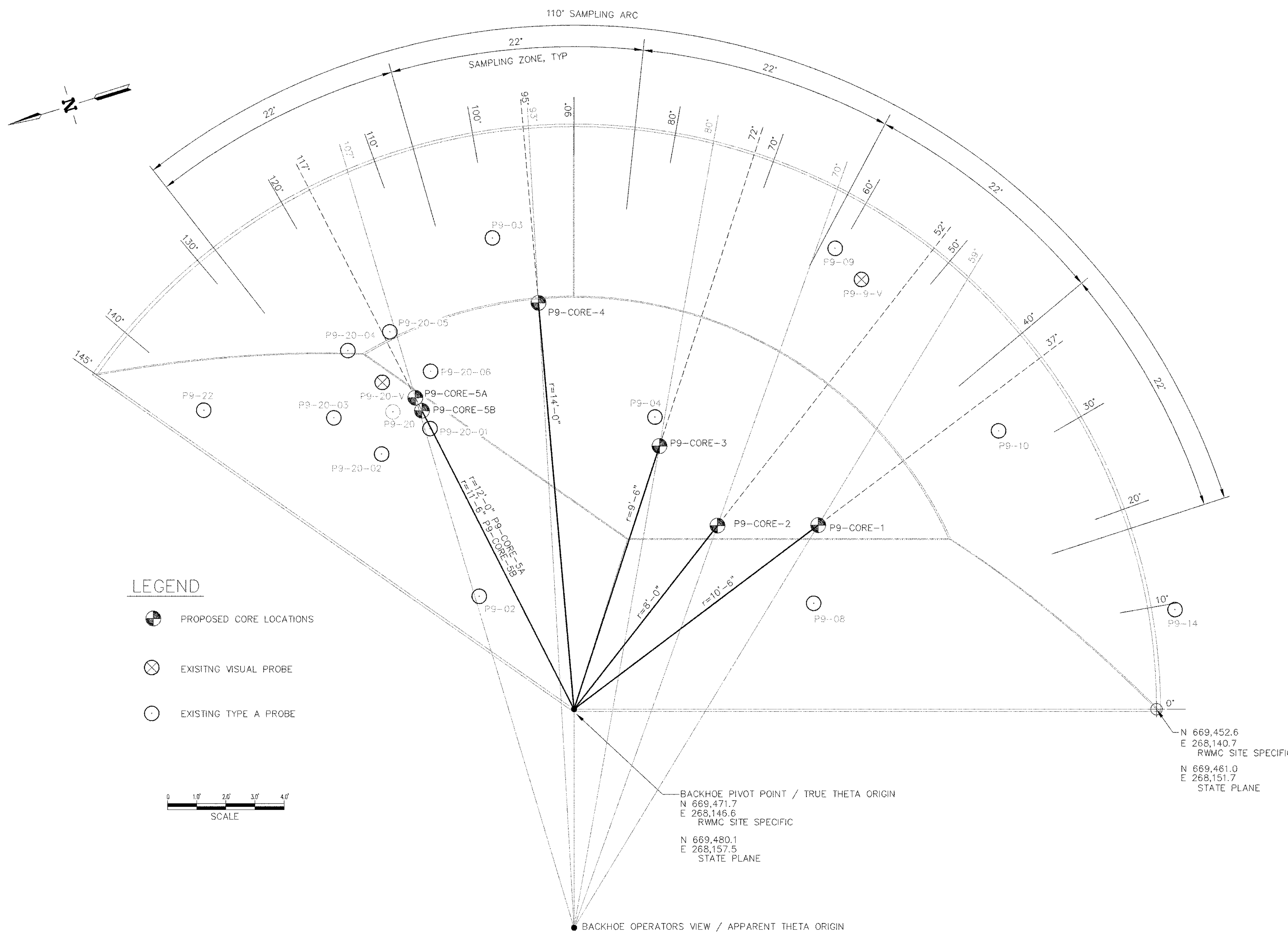

Figure 8. Proposed core locations for excavation bottom using r, θ d positioning system.

labeled as to orientation and depth interval, and the core material stored at 4°C until prepared for sample analysis. Subsamples will be collected from various core intervals to support identification of concentration gradients as a function of depth. When the core liner is advanced into the underburden to collect the sample, it is possible for some of the contaminated material to be smeared along the inside of the sample liner as well. Therefore, a thin layer of sediment should be removed from the core liner to avoid the possibility of cross contamination.

With a core diameter of 2 in., and a 1-ft-long interval, a volume of available sample material of about 450 cm^3 will be available after trimming the ends and outside surfaces of the core. This is sufficient sample material for approximately three radiological measurements (about 120 cm^3 per sample). Approximately 100 g would be used for water content measurement (about 60 cm^3 at a bulk density of 1.7 g/cm^3), which will use up essentially all of the core material. Table 5 represents the approach to sampling various intervals.

Table 5. Proposed approach to sampling cores.

Recovered Core Length	Number of Intervals Sampled	Core Interval Sample Guidance
First foot	3	Radionuclides: top, middle, and bottom VOCs: middle Water content: composite of interval Sequential extraction for radionuclides: composite of interval
Second foot	3	Radionuclides: top and bottom Soluble ions: middle Water content: composite of interval
Third foot	3	Radionuclides: middle Soluble ions: top and bottom Water content: composite of interval
Fourth foot	3	Radionuclides: top and bottom Soluble ions: middle Water content: composite of interval
Fifth foot	1	Radionuclides VOCs[a] Soluble ions Water content: composite of interval

a. If core is less than 4.5 ft long, the deeper VOC sample will be collected from the deepest available interval.
VOC = volatile organic compound

Based on this breakdown of sampling, if a full 4.5-ft core was collected, then nine radiological analyses, five soluble ions analyses, and five water content analyses would be performed per core.

A gamma spectroscopy analysis will be performed on the 120-cm^3 bulk sample. After counting, the 120 cm^3 sample will be subsampled for analysis of Ra-226, Am-241, Np-237, plutonium, and uranium isotopes by alpha spectroscopy. This will take approximately 50 g of the original sample material, estimated to be about 140 to 200 g. A 1 to 5 g VOC grab sample also will be collected from two intervals as described in Table 5. These samples evaluated in conjunction with the water content samples described below may indicate whether the solubility limit for VOCs is being approached. This evaluation would then be used to indicate whether free product exists in the underburden.

Water content will be measured by weighing the composite sample from each 1-ft interval, drying at 110°C to constant weight, and weighing the dried sample. Water content is calculated by difference in weight.

Soluble ions will be determined by mixing a 1:5 ratio of sample material and deionized water, then filtering the mixture to separate the water and sediment. The filtrate will be collected and the pH measured. The filtrate then will be analyzed for cations and metals by inductively coupled plasma and for anions by ion chromatography.

The residual sample material from the top 1-ft interval of each core will be mixed together to give a sample of about 300 to 450 g after removing the material for alpha spectroscopy from the gamma spectroscopy samples. This sample material will be sequentially extracted to determine the mobility of radionuclides in the underburden. The sequential extraction procedure will be compatible with techniques employed to produce historical data for INEEL soils. The difference between the extracted radionuclides and the total radionuclides gives an indication of immobile radionuclides in the sediment.

The laboratory will record staining or other unusual attributes to the original, unaltered sample material, and the notes transmitted with the analytical data package. Details of the laboratory core sectioning, including requirements to mitigate cross contamination during sectioning, will be included in the laboratory statement of work.

4. SAMPLE DESIGNATION

4.1 Sample Identification Code

A systematic 10-character sample identification (ID) code will be used to uniquely identify samples. Uniqueness is required for maintaining consistency and preventing the same ID code from being assigned to more than one sample (see Figure 9).

The first and second code designators, **P9**, refer to the sample originating from OU 7-10. The third designator, **G**, refers to the sample being collected in support of the project. The next character designates the category of sample (e.g., W for the composite of soils and waste solids). The next two alphanumeric identifiers designate the sequential sample number for the category of sample. A two-character set (i.e., 01, 02, 03) then will be used to designate the number of samples to be collected from the same location (e.g., field duplicate samples). The last two characters refer to a particular analysis type. (Refer to the sampling and analysis plan [SAP] tables in Appendix A for specific analysis code designations.)

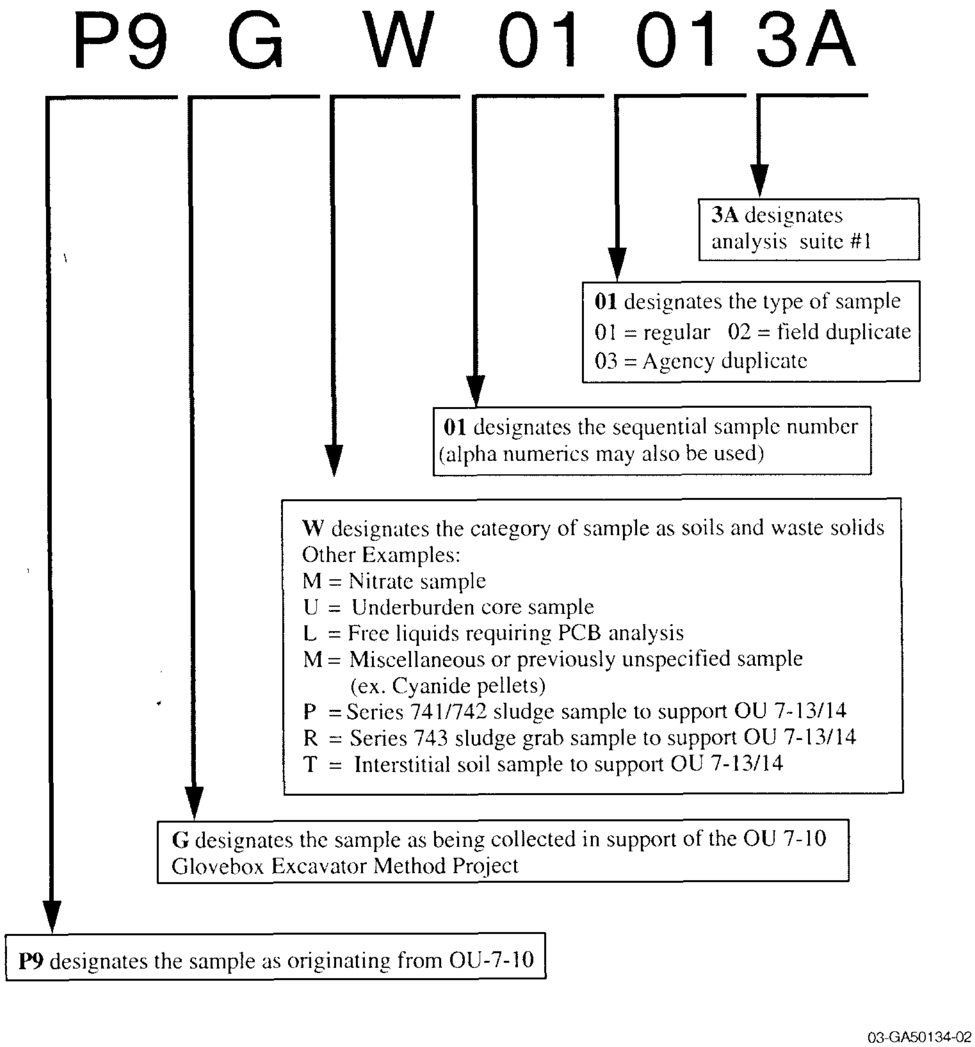

Figure 9. A systematic 10-character sample identification code will be used to uniquely identify samples.

A SAP table and database will be used to record all pertinent information associated with each sample ID code. Issuance and control of sample IDs will be coordinated with the Integrated Environmental Data Management System technical leader of the Sample Management Office (SMO).

4.2 Sampling and Analysis Plan Table and Database

4.2.1 General

A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following sections describe the information recorded in the SAP table and database, which is presented in Appendix A.

4.2.2 Sample Description Fields

The sample description fields contain information about individual sample characteristics.

4.2.2.1 Sampling Activity. The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (e.g., field data and analytical data) to the information in the SAP table for data reporting, sample tracking, and completeness reporting. The analytical laboratory also will use the sample number to track and report analytical results.

4.2.2.2 Sample Type. Data in the sample type field will be selected from the following:

REG = Regular sample

QC = Quality control sample.

4.2.2.3 Sample Matrix. Data in sample matrix field will be selected from the following:

Soil = Cores

Waste = Waste zone materials

Liquid = Free liquid analyzed for PCBs

Water = Quality assurance and quality control samples.

4.2.2.4 Collection Type. Data in the collection type field will be selected from the following:

GRAB = Grab

COMP = Composite

FBLK = Field blanks

TBLK = Trip blanks

RNST = Rinsates

DUP = Duplicates.

4.2.2.5 *Planned Date.* This date is related to the planned sample collection start date.

4.2.3 Sample Location Fields

This group of fields pinpoints the location for the sample in three-dimensional space, starting with the general area, narrowing the focus to a grid location geographically, and then specifying the depth in the depth field. For samples representing newly packaged (drummed) waste, this field will be populated with the drum ID number.

4.2.3.1 *Area.* This field identifies the general sample-collection area (i.e., RWMC – PIT9).

4.2.3.2 *Location.* This field will typically contain the drum number(s) in which the waste was placed (field may be populated after the sample is collected). For core sample, it will contain the core location ID.

4.2.3.3 *Type of Location.* This field supplies descriptive information concerning the sample location (e.g., underburden and waste zone).

4.2.3.4 *Depth.* The depth of a sample location is the distance in feet from surface level or a range in feet from the surface. Core sample depth ranges will be added to the depth of excavation resulting in a depth range tied to the distance below ground surface. (This field may be populated after the sample is collected.)

4.2.4 Analysis Types

4.2.4.1 *AT1 through AT20.* These fields contain analysis code designations. Specific descriptions for these analysis codes are provided at the bottom of the SAP table.

5. SAMPLING EQUIPMENT AND PROCEDURES

This section describes the sampling procedures and equipment the project will use to collect project samples. Specific INEEL TPRs will be developed to implement the sampling activities. This section describes operational features that will be incorporated into TPRs to support successful sample acquisition during this project.

Before the commencement of any sampling activities, a presampling meeting will be held to review the requirements of this FSP, the QAPjP, relevant TPRs, and operational safety documents, and to ensure that the project and sampling objectives are understood and that all supporting documentation has been completed.

The project will supply space to house equipment and materials used to support collection, preparation, storage, and transportation of samples in accordance with custody and sample handling requirements. These include:

- Lockable sample refrigerator to store samples before shipment to the laboratory, as required
- Sample freezer to store ice for sample temperature control during transport
- Storage cabinets to store sampling equipment and supplies.

Sampling equipment or tools (e.g., scoops, core liners, and caps) must be visually inspected before use. All sampling equipment must be stored in its protective bag-in wrap until initial use (see description in Section 5.3.1). Project personnel will visually assess protective wrappings before removal. Sampling equipment with torn protective wrapping should be discarded.

The following sections include guidance on the collection of QA/QC samples, visual inspection, and then guidance on sample collection, which is divided by the origin of the sample materials (waste zone and underburden).

5.1 Quality Assurance and Quality Control Samples

The INEEL SMO will issue a task order scope of work for established laboratories to analyze samples described by this plan, and data from the analyses will be considered definitive. All internal laboratory QA/QC procedures will be followed in accordance with the appropriate laboratory statements of work prepared for this project. Table 1-5 of the QAPjP describes generally recommended field QA sampling. That table includes the items described in the following subsections.

5.1.1 Duplicates

For this project, duplicate samples will be collected at the frequency prescribed in the QAPjP, if sufficient sample material exists. Table 1-5 of the QAPjP recommends collecting the duplicate samples at a frequency of 5%. This collection frequency is represented in the SAP tables contained in Appendix A. It is possible that duplicate samples called out in the tables in Appendix A cannot be collected as planned because of insufficient volume, such as may be expected for free liquids analyzed for PCBs. Alternate duplicates then may be collected along with successive regular samples and the deviation will be recorded in the sample logbook. Duplicates will be collected in the same manner as the regular sample with which they are being collected.

5.1.2 Duplicates of Core Samples

For the underburden core samples, one location (i.e., P9-CORE-5) is planned for duplicate sample collection (regular sample location designated as P9-CORE-5A and duplicate as P9-CORE-5B). These cores will be collected as close as possible to each other. At the analytical laboratory, sectioning of the cores will take place in accordance with the breakdown in Table 5.

5.1.3 Duplicates of Waste Zone Materials

Duplicates are required from all waste zone matrices including waste potentially containing nitrates, cyanide pellets and free liquids potentially containing PCBs. These will be collected in the same manner and as close as possible and from the same fractions and in the same proportions as the regular sample to which they represent. Use of the same sampling device is acceptable between the regular and duplicate samples. Duplicate sample collection is not required for OU 7-13/14 Project waste zone samples (suspect sludges and interstitial soils).

5.1.4 Field Blanks

Field blanks will not be collected as part of this investigation. Field blanks are generally used to evaluate cross contamination during sample collection activities. In accordance with the QAPjP, for the project sample matrices, field blanks are only recommended for soils being analyzed for radionuclides. For this project, this applies only to underburden cores. Controls are being developed to mitigate cross contamination of recovered soil cores with contamination expected in the RCS. In addition, collection of a field blank in the RCS would be extremely difficult to implement at the excavation bottom in the RCS. Finally, sectioning of cores will not take place in the RCS. The upper and lower portion of the cores will be discarded from analysis. These factors make collection of field blanks unnecessary.

5.1.5 Equipment Rinsate Blanks

Equipment rinsate blanks will not be collected as part of this investigation because new, disposable sampling equipment is being used for all phases of sampling (both waste zone samples and underburden cores). This is consistent with the requirements of the QAPjP.

5.1.6 Trip Blanks

In accordance with the QAPjP, trip blanks are not required for the matrices being analyzed by this project.

5.2 Visual Examination

Visual examinations will be performed on recovered waste zone material and of the excavation bottom, before coring. Evidence of staining on the underburden surface may result in movement of proposed core locations to target areas of maximum staining (see Section 3.3). Visual examination of waste zone material will be conducted in the PGS area. Information may be obtained visually that will aid in identifying waste streams requiring additional sampling (e.g., free liquids and pellets potentially containing cyanides). Operators will receive training to identify specific waste and situations where certain waste handling procedures are followed. For example, if special-case waste items (also known as outliers) are present in the glovebox, the process may proceed to certain decision points other than sampling and packaging operations. Special-case waste items represent occurrences whereby additional precautions will be required to mitigate conditions that warrant a safety concern. Technical procedures will be developed and training will be provided to visually identify potential special-case waste items expected to be found in the PGS that would require special handling.

Video cameras will be used to augment direct observations. In addition, the cameras will aid the operators collecting core samples from the underburden that may otherwise be hidden from direct line of sight. Video recording also will provide an archival record of the operations filmed, which will be available for future evaluation.

5.3 Sampling Waste Zone Materials

A detailed description of the location frequency and approach to collection of waste zone samples is given in Section 3. This section provides additional guidance needed to ensure proper sample collection and starts with an overview of the approach to handling waste zone material in the PGS.

The PGS receives excavated waste zone material from the RCS for sampling, sizing, and repackaging. Waste zone material is placed in transfer carts from the excavator and is moved through the glovebox in the transfer cart. The transfer carts may contain sludge, interstitial soil, debris, cemented waste, or a combination of these. Other material or items that may be encountered in the glovebox include classified objects, special-case waste items, and free liquids. Not all of the waste material will be subjected to sampling. In accordance with operating procedures, debris, containerized materials, laboratory packs, lead, and other materials will not be subject to sampling in the PGS. Other PGS activities will include sizing, segregation, packaging, and special handling of such items as unique or special-case waste items and classified objects.

5.3.1 Collection of Samples from Soils and Waste Solids

The sampling process requires the collection of small incremental subsamples from each cart used to fill each drum in a five-drum campaign. Subsamples from all carts used to fill five drums are composited into one sample representing the five-drum campaign. The sampling location and frequency are detailed in Section 3.2.1 and graphically represented in Figure 6. Samples of waste zone solids will be collected using disposable sampling scopes and spatulas (as required). The sampling scoops will be appropriate for collection of subsamples of approximately 15 cm^3 from each transfer cart. Larger pieces of waste that cannot be sized to reflect its representative contribution to the incremental subsample (e.g., rock pebbles or highly solidified waste) may be excluded from the subsample. If waste is excluded that would otherwise have been included, it will be noted in the sample log. The sampling supplies will be bagged in the glovebox for each sampling event (e.g., collection of one regular and its duplicate, as appropriate). The sampling kit will be transferred into the glovebox line in a closed plastic bag and will contain the following supplies:

- A 250-mL wide-mouth certified clean, clear glass sample jar and lid that has been prelabeled with its sample number
- Second sample jar for duplicate analysis (similar configuration), as required
- Sampling scoop with an approximate capacity of 15 cm^3
- Sampling spatula (optional).

After collection of each subsample, the sample jar will be closed, as appropriate, until the next subsample is ready to be added to the sample jar. These samples will be collected in accordance with Section 3.2, and operational considerations established in a future TPR. Before pulling aliquots for analyses, the receiving analytical laboratory will homogenize this sample in accordance with the requirements of the laboratory statement of work.

5.3.2 Collection of Samples from Materials Potentially Containing Nitrate-Bearing Waste

When the visual screening described in Section 3.2.2 indicates the potential presence of nitrates, biased samples will be collected. One sample will be collected to represent each filled drum. It will contain material from the cart(s) containing suspect nitrate-bearing material. The sample will be collected to represent (proportionally) both suspect and nonsuspect material from the cart. It is assumed that nitrate salts would have a yellow or white granular or crystalline appearance, or possibly be in flake form. The same type of sampling equipment described in Section 5.3.1 will be used to collect samples of nitrate-bearing waste.

5.3.3 Collecting Samples of Uncontainerized Liquids for Polychlorinated Biphenyls Analysis

Samples will be collected from free liquids encountered in carts to determine if they contain PCBs and at what levels, providing a minimum sample volume of 100 mL can be collected. Sampling will be performed before any operationally required stabilization activities. Analyses of these samples will be used to determine the as-found PCB concentration, if any. If the contents of several carts are used to fill a single drum and more than one cart contains free liquids, subsamples will be required from each cart's liquid fraction and combined to form one sample. This ensures that the contents of the drum have had portions of all liquids analyzed.

Free liquids may be collected from the carts with a disposable pipette, syringe, aspirator bottle, or a new, uncontaminated sample bottle. Free liquids then will be transferred as appropriate to a certified, prelabeled 250 mL clear glass sample container.

5.3.4 Collecting Samples of Pellets Potentially Containing Cyanide

Biased samples will be collected for total cyanide analysis if uncontainerized pellets are encountered in the PGS. These pellets potentially contain concentrated cyanides. These samples will be collected for every drum in which suspect pellets are disposed. The same sampling equipment described in Section 5.3.1 will be used to collect samples of pelletized material.

5.3.5 Collecting Samples of Sludge and Interstitial Soil to Support Requests by Operable Unit 7-13/14

Biased samples of sludges and interstitial soil will be collected in accordance with Section 3.2.5. These samples will be collected as biased grabs from the freshest material believed to be least affected by retrieval activities. To support this effort, the sludge sample material will come from as close as possible to the central mass of sludge originating from a buried drum. Scoops may be used to gain access to candidate material. The grab samples will be collected in a manner that reduces loss of volatiles during the sample collection process. The sample container will be tightly packed with sludge to minimize void space within the sample jar. Visual characteristics identified in Section 3.2.5 will be used to identify the candidate material for sampling. The same types of sampling equipment described in Section 5.3.1 are expected to be used to collect these samples. The sample container used will depend on selection of analytical requirements.

5.3.6 Collecting Samples of Interstitial Soil for Turnover to the Agencies

As many as 10 biased samples of interstitial soil will be obtained as described in Section 3.2.7 and turned over to the EPA. To send the desired 600-g quantity to the EPA, each sample will be packaged in two of the standard 250-ml wide-mouth jars used by the project, in place of the sample container specified in Figure 7. These samples will be handled in a manner consistent with this plan until transfer to the EPA is complete. In instances where these samples are collected, collocated samples also will be collected for OU 7-13/14 as part of the requested 36 interstitial soil samples.

5.4 Underburden Core Sampling

Underburden core sampling will be conducted in accordance with the requirements of Section 3.3. Standard off-the-shelf coring equipment is currently being evaluated. The core procedure will be detailed in a future TPR. The procedure will include collection and handling requirements focused on minimizing cross contamination during collection and handling in the RCS. Sectioning of the core (subsampling) will take place in a clean environment away from the RCS to avoid cross-contamination issues.

Most cores are expected to be less than the 4.5-ft-long core liner. Core integrity is important to determine attenuation of radionuclides with depth under the buried waste and the core must be handled so that partial cores do not crumble. A compressible plug (e.g., a cork or Styrofoam-based insert) will be placed in the bottom end of the core liner before the core is collected. The plug will be displaced up the core liner as the core is collected. The plug shall fit tightly enough such that it can be displaced up the liner as the core advances, but will prevent the core from crumbling into the unfilled portion of the core liner during subsequent handling and transportation activities.

6. SAMPLE HANDLING AND ANALYSIS

6.1 Documentation

The sampling coordinator will be responsible for controlling and maintaining all field documents and records and for ensuring that all required documents are submitted to the INEEL ER Administrative Records and Document Control. All entries will be made in permanent ink. All errors will be corrected by drawing a single line through the error and entering the correct information. All corrections will be initialed and dated.

6.1.1 Sample Container Labels

Waterproof, gummed labels will display information such as the sample ID number, the name of the project, sample location, and analysis type. In the field, labels will be completed and placed on the containers before sample collection. Information concerning sample collection date, time, preservative used, field measurements of hazards, and the sampler's initials will be filled out during field sampling activities. If conditions do not allow for the sampler's initials and collection date and time to be accurately placed on the sample label (e.g., preloading the sample containers into the PGS), then this information can be recorded on the chain-of-custody (COC) record described below. The MCP-1192, "Chain of Custody and Sample Labeling for ER and D&D&D Projects," establishes the container labeling procedure for this project. The exception to this procedure is that certain information (e.g., collection date and time) may be left off the labels as long as the information is recorded on the COC record.

6.1.2 Logbooks

Information pertaining to sampling activities will be entered in the sample logbook. Entries will be dated and signed by the individual making the entry. All logbooks will have a quality control check for accuracy and completeness. The MCP-1193, "Logbook Practices for ER and D&D&D Projects," establishes the logbook use and administration procedure for this project.

6.1.3 Data Management

For this short-duration project, sampling and analytical data will be managed in hardcopy format. The project may integrate, as practicable, currently existing data management systems (e.g., Integrated Environmental Data Management System) for the control of analytical sample information collected in support of the project.

6.2 Sample Handling

6.2.1 Sample Preservation

Samples will be preserved by chilling once they leave the PGS. During some operations maintaining temperature at 4°C may be difficult. Efforts will be made to maintain sample temperature requirements as close as practical considering the difficulties with these samples.

6.2.2 Sample Custody

The COC record is a form that serves as a written record of sample handling. When a sample changes custody, the person(s) relinquishing and receiving the sample will sign a COC form. Each change of possession will be documented, thus a written record that tracks sample handling will be established. The custody procedure for this project is established by MCP-1192.

6.2.3 Sample Transportation

The project is currently addressing transportation requirements for samples and sample waste between the project site and the Idaho Nuclear Technology and Engineering Center laboratory.

7. WASTE MANAGEMENT

Waste streams generated as a result of the project field sampling activities will be managed as CERCLA waste. The project activities are being conducted under the OU 7-10 ROD, in accordance with CERCLA. Therefore, all waste streams identified in this plan, while being managed onsite, will be managed in accordance with the substantive requirements of applicable or relevant and appropriate requirements which include RCRA and TSCA. Administrative requirements (e.g., timeframes or reporting requirements) do not apply to the waste while remaining in CERCLA storage, but may be implemented if required by internal INEEL procedures or may be adopted as best management practices. If CERCLA waste is shipped off-Site to a treatment, storage, and disposal facility, the waste must comply with all applicable regulatory requirements (e.g., administrative and substantive) in accordance with the CERCLA Offsite Rule (58 FR 49200).

The waste management approach and practices described here are consistent with the waste management plan that is being developed for the project (INEEL 2003). Waste generated from sampling activities is a small subset of the waste being generated and managed by the project. It is the intention of the project to manage as much of the sampling waste as possible with other similar, but larger volume waste being generated and managed by the project. For example, sampling equipment and wipes used to collect samples of waste zone material being packaged in drums will be managed and disposed of in those same drums after the sampling equipment is no longer needed. Waste management activities will be performed in a manner that protects human health and the environment and achieves waste minimization, to the extent possible.

This plan does not address sample waste or incidental materials generated from samples turned over to regulatory Agencies for analyses. Once the samples are turned over to the Agencies, ownership, handling, and disposition of these materials are the responsibility of the receiving agency and are outside the scope of this plan.

7.1 Waste Types and Disposition Logic

The project will generate various types of waste from both sampling and analytical activities. These include:

- Sample-collection waste generated within the confines of the project gloveboxes
- Unaltered, unused samples
- Analysis residues and miscellaneous laboratory waste.

Sample collection waste includes used disposable sampling tools (e.g., scoops and spatulas), wipes, plastic bags, and gloves that were used in the collection of samples within the project gloveboxes. These items will be dispositioned in the drums of waste zone material for which they were used to sample. Addition of this sampling waste will not alter the waste characterization of the contents of the drums to which they were added.

Unaltered and unused sample portions will be turned over to the OU 7-13/14 Project to support contaminant migration or treatability studies in accordance with Interface Agreement (IAG) –149, "Interface Agreement Between the OU 7-10 Glovebox Excavator Method Project and the Analytical Laboratories Department."

Analysis residues and miscellaneous laboratory waste may be managed differently than unaltered sample waste. Analysis residues include both underburden cores and waste zone samples that have been altered through analytical processes, typically by the addition of chemicals to support analysis. Analysis residues are expected to contain laboratory reagents (e.g., as methylene chloride, methanol, hexane, various acids and other chemicals) in addition to what was in the original sample. Miscellaneous laboratory waste includes glassware, filters, and stirring devices that were potentially contaminated by the sample and laboratory reagents. Altered samples and miscellaneous laboratory waste from this project may be combined. The laboratory reagents may add additional waste codes (hazardous waste numbers) to the original sample material. Processing of these types of waste, which includes absorption of free liquids and proper packaging to support compliant storage, will be supported by the Waste Generator Services organization at the Idaho Nuclear Technology and Engineering Center laboratories. The laboratory, as the waste generator, will work with the Waste Generator Services organization to ensure proper identification, coding, and reporting of hazardous constituents in the altered waste. The processed waste will be stored in a satellite accumulation area. Waste Generator Services will ensure proper disposition or disposal of the material. The agreement outlining this activity is contained in IAG-149.

The project will consider segregating analysis residues from characterizing nitrate-bearing waste if those residues could exhibit a characteristic of ignitability. This segregation could prevent classifying more waste than is necessary as ignitable waste.

Table 6 summarizes the types of waste anticipated to be generated during the sampling effort, projected waste classification, waste quantity, and expected disposition paths.

7.2 Waste Determinations

All waste streams resulting from the sampling efforts will be identified, characterized, and managed in accordance with the requirements and processes defined in the federal and state regulations; DOE Order 435.1, "Radioactive Waste Management"; DOE Order 5400.5, "Radiation Protection of the Public and the Environment"; the OU 7-10 ROD; INEEL WAC (Revision 16) (DOE-ID 2002c); and the following company management procedures, as appropriate:

- MCP-62, "Waste Generator Services Low-Level Waste Management"
- MCP-63, "Waste Generator Services Conditional Industrial Waste Management"
- MCP-69, "Waste Generator Services Hazardous Waste Management"
- MCP-70, "Waste Generator Services Mixed Low-Level Waste Management"
- MCP 3472, "Identification and Characterization of Environmentally Regulated Waste"
- MCP-3475, "Temporary Storage of CERCLA-Generated Waste at the INEEL"
- MCP-3480, "Environmental Instructions for Facilities, Materials, and Equipment."

Table 6. Sampling waste stream disposition path summary.

Expected Waste Stream	Potential Waste Classification	Estimated volume	Potential Disposition Path
Sample-collection waste including used, disposable sampling tools (e.g., scoops and spatulas), wipes, plastic bags, and PPE, which were used in the collection and processing of samples within the confines of the project (i.e., gloveboxes and others areas).	MTRU waste (potentially TSCA because of PCBs), low-level mixed waste, low-level radioactive waste and industrial waste	<1 m^3 (processed with other project waste and not tracked individually)	These items will be dispositioned in the drums of waste zone material for which they were used to sample. Addition of this sampling waste will not alter the waste characterization of the contents of the drums to which they were added.
Unaltered waste zone samples and underburden core material, unused by the analytical laboratory	Not applicable	<1 m^3	Transfer to the OU 7-13/14 Project in accordance with IAG-149.
Analysis residues (altered waste zone samples and underburden core material containing residues of laboratory analytical reagents) and contaminated laboratory equipment (e.g., glassware and filters).	MTRU waste (potentially TSCA because of PCBs). These sample residues and other materials may contain methylene chloride, methanol, hexane, various acids, and other chemicals added as part of laboratory analyses.	<1 m^3	Initial processing and packaging is expected to be done at the analytical laboratory and may include absorption of any free liquids. The processed, waste is expected to be stored in a satellite accumulation area. Waste Generator Services will ensure proper disposition or disposal of the material.

IAG = interface agreement
MTRU = mixed transuranic waste
PCBs =- polychlorinated biphenyls
PPE = personal protective equipment
TSCA = Toxic Substances Control Act

A hazardous waste determination (HWD) will be conducted for each waste stream in accordance with the requirements in 40 CFR 262.11, "Hazardous Waste Determination," to guide proper management of the waste. The determination will also include a TSCA evaluation in accordance with 40 CFR 761, "Polychlorinated Biphenyls (PCBS) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions." These determinations may be documented on Form 435.39, "INEEL Waste Determination and Disposition Form." The initial HWD will be based on acceptable knowledge from the OU 7-10 inventory documents identified in Section 1. In addition, characterization data will supplement acceptable knowledge documentation.

7.3 Pollution Prevention and Waste Minimization

Pollution prevention and waste minimization techniques have been and will continue to be incorporated into planning and daily work practices to improve work safety and efficiency and to reduce environmental and financial liability.

Examples of practices instituted to support pollution prevention and waste minimization include:

- Implementing a statistical sampling approach that, by minimizing the numbers of samples taken, minimizes the generation of sample-collection waste (e.g., disposal scoops and sample jars) and reduces the waste generated resulting from laboratory analysis.

- Conducting retrieval and sampling activities using remote operations including the use of cameras and windows not only protects the workers, but also reduces personnel entry. This results in a significant reduction in generation of personal protective equipment (PPE) waste.

- Controlling transfer of samples between contaminated zones and clean areas, which minimizes the spread of contamination and generation of new waste.

As part of required prejob briefings, the project will emphasize waste reduction philosophies and techniques and encourage personnel to continuously improve methods for minimizing generated waste. Specific practices to be implemented include the following:

- Restricting material (especially hazardous material) entering radiological buffer areas, to that needed for work performance

- Reusing items when practical

- Using dry decontamination to prevent generation of liquid decontamination waste

- Segregating contaminated from uncontaminated waste

- Segregating reusable items (e.g., PPE and tools).

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